Operating Instructions

Datascope
AS3000™

ANESTHESIA DELIVERY SYSTEM

mindray™
NORTH AMERICA

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Operating Instructions

Datascope AS3000™

ANESTHESIA DELIVERY SYSTEM

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NORTH AMERICA

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Foreword

The **AS3000** Anesthesia Delivery System Operating Instructions are intended to provide information for proper operation.

General knowledge and understanding of the features and functions of the **AS3000** Anesthesia Delivery System are prerequisites for its proper use.

NOTE: Do not operate this system before reading these instructions.

Information for servicing this instrument is contained in the **AS3000** Anesthesia Delivery System Service Manual, part number 0070-00-0683. For additional information or assistance, please contact an authorized representative in your area.

CAUTION: U.S. Federal Law restricts this device to sale by or on the order of a physician or other practitioner licensed by state law to use or order the use of this device.

NOTE: Figures in this manual are provided for reference purposes only. Screens will likely differ based on the system configuration and selected parameters.

Warnings, Cautions, and Notes

Please adhere to all warnings, cautions, and notes that are listed throughout this manual.

A **WARNING** is provided to alert the user to potential serious outcomes (death, injury, or serious adverse events) to the patient or the user.

A **CAUTION** is provided to alert the user to use special care necessary for the safe and effective use of the device. They may include actions to be taken to avoid effects on patients or users that may not be potentially life threatening or result in serious injury, but about which the user should be aware. Cautions are also provided to alert the user to the adverse effects on this device due to misuse and the care necessary to avoid such effects.

A **NOTE** is provided when additional general information is applicable.

Warnings

WARNING: In order to prevent an electric shock, the machine (protection class I) may only be connected to a correctly grounded mains connection (socket outlet with grounding contact).

WARNING: Possible explosion hazard. Do not operate machine near flammable anesthetic agents or other flammable substances. Do not use flammable anesthetic agents (i.e., ether or cyclopropane.)

WARNING: The use of anti-static or electrically conductive breathing tubes, when utilizing high frequency electric surgery equipment, may cause burns, and is therefore not recommended in any application of this machine.

WARNING: Possible fire hazard. Fuses (i.e., additional sockets) must only be replaced by fuses of the same type and with the same rating.

WARNING: Possible electric shock hazard. The machine may only be opened by authorized service personnel.

WARNING: Do not use a broken unit or accessory. Periodically check all cables (e.g., AC line cord and patient connection cables) for damage that may occur through normal use. Replace cable if damaged in any way.

WARNING: Compressed gasses are considered Dangerous Goods/ Hazardous Materials per I.A.T.A. and D.O.T. regulations. It is a violation of federal and international law to offer any package or over pack of dangerous goods for transportation without the package being appropriately identified, packed, marked, classified, labeled, and documented according to D.O.T. and I.A.T.A. regulations. Please refer to the applicable I.A.T.A. Dangerous Goods Regulations and/or the Code of Federal Regulations 49 (Transportation, Parts 171-180) for further information.

WARNING: The patient should be visually monitored by qualified personnel. In certain situations, life-threatening circumstances may occur which may not necessarily trigger an alarm.

WARNING: Always set the alarm limits so that the alarm is triggered before a hazardous situation occurs. Incorrectly set alarm limits may result in operating personnel not being aware of drastic changes in the patient's condition.

WARNING: This machine must only be operated by trained, skilled medical staff.

WARNING: Connection of equipment to the auxiliary mains socket outlet(s) may increase the leakage currents to values exceeding the allowable limits.

WARNING: Electric shock and fire hazard: Do not clean the machine while it is on and/or plugged in.

WARNING: Disconnect the power plug from the mains supply before removing the rear panels or servicing the AS3000 unit.

WARNING: Independent means of ventilation (e.g. a self-inflating manually powered resuscitator with mask) must be available whenever the AS3000 is in use.

WARNING: Malfunction of the central gas supply system may cause more than one or even all devices connected to it to stop their operation simultaneously.

WARNING: The anesthesia system will cease to deliver gas at pressures below the minimum specified gas pipeline supply pressure.

WARNING: Use a cleaning and disinfection schedule that conforms to your institution's disinfection and risk-management policies.

- **Refer to the material safety data as applicable.**
- **Refer to the operation and maintenance manuals of all disinfection equipment.**
- **Do not inhale fumes that may result from any disinfection process.**

WARNING: Use extreme care while handling the absorbent as it is a caustic irritant.

WARNING: Use care in lifting and manipulating vaporizers during the mounting process as their weight may be greater than expected, based on their size and shape.

WARNING: Use care in lifting and manipulating the breathing system block during removal from its mounting arm as handling may be awkward due to its weight and shape.

WARNING: Do not use talc, zinc stearate, calcium carbonate, corn starch or similar material to prevent sticking of the bellows, as these materials may enter the patient's lungs or airway, causing irritation or injury.

WARNING: All gas supplies should be of medical grade.

WARNING: Single use respiratory hoses and face masks should not be reused.

WARNING: To avoid endangering a patient, do not perform testing or maintenance when the machine is in use.

WARNING: Review the performance specifications of the disposal system with which the transfer and receiving systems are intended to be used, to ensure compatibility.

WARNING: The AS3000 should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the AS3000 should be observed to verify normal operation in the configuration in which it will be used.

WARNING: Ensure that the current alarm presets are appropriate prior to use on each patient.

WARNING: Ensure that both O_2 and N_2O flow controllers are turned OFF fully at the start and at the end of each case.

WARNING: Due to the size and weight of the A3000, it should only be moved by qualified personnel.

WARNING: To avoid tip hazards, use care when moving the AS3000 up or down inclines, around corners and across thresholds. Remove all monitoring equipment mounted to the side of the AS3000 prior to transport. Do not attempt to roll the AS3000 over hoses, cords or other obstacles.

WARNING: Remove all equipment from the top shelf of the AS3000 before moving.

WARNING: Do not remove the absorber canister while the ventilator is running in an automatic ventilation mode. This should only be done in STANDBY mode with no patient connected.

Cautions

CAUTION: **Perform the daily checks specified on the checklist and, in case of a fault, do not operate the system until the fault has been corrected.**

CAUTION: **Before starting the machine, users must be familiar with the information contained in these Operating Instructions and must have been trained by an authorized representative.**

CAUTION: **If the machine does not function as described, it must be examined and repaired as necessary by qualified service personnel before being returned to use.**

CAUTION: **Handle the machine with care to prevent damage or functional faults.**

CAUTION: **Ensure that the gas supply of the machine always complies with the technical specifications.**

CAUTION: **Before clinical use, the machine must be correctly calibrated and/or the respective tests must be performed, as described in these Operating Instructions.**

CAUTION: **If faults occur during the initial calibration or testing, the machine should not be operated until those faults have been corrected by a qualified service person.**

CAUTION: **After servicing, functional, sensor, and system tests must be performed before clinical use.**

CAUTION: **Only bacterial filters with a low flow resistance should be connected to the Breathing System and/or the patient connection.**

CAUTION: **After changing the CO_2 pre-paks, perform a fresh-gas system leak test.**

CAUTION: **After changing the loose fill absorbent, perform a fresh-gas system leak test.**

CAUTION: **Only vaporizers with Interlock-System may be used with the AS3000 unit.**

CAUTION: **After each exchange of a vaporizer, perform a fresh-gas system leak test.**

CAUTION: **Use cleaning agent sparingly. Excess fluid could enter the machine, causing damage.**

CAUTION: **Do not autoclave any parts of the AS3000 unless specifically identified as autoclaveable in this manual. Clean the AS3000 only as specified in this manual.**

CAUTION: **Do not autoclave the airway pressure limiting (APL) valve.**

CAUTION: **This Anesthesia System is NOT suitable for use in a magnetic resonance imaging (MRI) environment.**

CAUTION: **To prevent system damage:**

- **Refer to the literature supplied by the manufacturer of the cleaning agent.**
- **Never use organic, halogenated or petroleum-based solvents, anesthetics, glass cleaning agents, acetone or other irritant agents.**
- **Never use abrasive agents (i.e. steel wool or silver polish) to clean components.**
- **Keep all liquids away from electronic components.**
- **Prevent liquid from entering the equipment.**
- **All cleaning solutions used must have a pH between 7.0 and 10.5.**

CAUTION: Never immerse the oxygen sensor or its connector in any type of liquid.

- **Dispose of the oxygen sensor per the manufacturer's specification.**

CAUTION: Do not use acetic hydroperoxide or formaldehyde steaming.

CAUTION: The valve disc is fragile and must, therefore, be handled with care while removing the valve cage from the valve assembly.

CAUTION: The valve disc is fragile and must, therefore, be handled with care while removing it from the valve cage.

CAUTION: If moisture remains in the bellows after cleaning, it may become tacky.

CAUTION: Communications connectors are for Service Technician use only. Any computer connected to this equipment must comply with IEC 60950.

CAUTION: Do not wash the inner surface of the oxygen sensor.

CAUTION: Do not autoclave the oxygen sensor.

CAUTION: Prior to use after cleaning or disinfecting, power up the system as described in section 2.6 and follow the on-screen prompts to perform the Leak Test and the Compliance Test.

CAUTION: The PAW gauge and oxygen sensor cannot withstand immersion or the heat and pressure of autoclaving.

CAUTION: When installing absorber Pre-Paks assure the bottom of the Pre-Pak rests on the top of the gasket inside the absorber canister.

CAUTION: Users should monitor oxygen percentage (O2%) when using the Auxiliary O2/AIR Flow Meters. Unknown oxygen concentrations may be delivered to the patient unless oxygen monitoring is used.

CAUTION: Verify that the bellows is fully inflated before starting an automatic ventilation mode on the patient. If the bellows is deflated and at the bottom of its travel at the start of an automatic ventilation mode, the bellows may become deformed.

Notes

NOTE: **The AS3000 is intended to be operated with its integral Breathing Pressure monitoring in use.**

NOTE: **The AS3000 is intended to be operated with its integral Breathing Pressure limitation devices in use.**

NOTE: **The AS3000 is intended to be operated with its integral Exhaled Volume monitoring in use.**

NOTE: **The AS3000 is intended to be operated with its integral Breathing System integrity Alarm System in use.**

NOTE: **The AS3000 is intended to be operated with its integral Continuing Pressure Alarm in use.**

NOTE: **The AS3000 is intended to be operated with its integral O_2 monitoring in use.**

NOTE: **The AS3000 is intended to be operated with an external CO_2 monitor complying with ISO 21647. Connection to the CO_2 monitor should be via a sample line from the Patient Circuit.**

NOTE: **Any Anesthesia Vapor Delivery Device is to be used with an Anesthetic Agent Monitor complying with ISO 21647. Connection to the Agent monitor should be via a sample line from the Patient Circuit.**

NOTE: **The AS3000 batteries are not user serviceable components. Only an authorized service representative can replace the batteries. If the system is not used for an extended period, contact a service representative to have the batteries disconnected. The batteries may be subject to local regulations regarding disposal. At the end of the battery life, dispose of the batteries in accordance with any local regulations.**

Intended Use

The **AS3000** Anesthesia Delivery System is a device used to administer to a patient, continuously or intermittently, a general inhalation anesthetic, and to maintain a patient's ventilation.

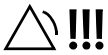
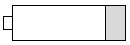
The **AS3000** is intended for use by licensed clinicians, for patients requiring anesthesia within a health care facility, and can be used in both adult and pediatric populations.

Unpacking

Remove the machine from the shipping carton and examine it for signs of shipping damage. Save all packing materials, invoice, and bill of lading. These may be required to process a claim with the carrier. Check all materials against the packing list. Contact the Customer Service Department at (800) 288-2121 or (201) 995-8237 for prompt assistance in resolving shipping problems.

Symbols

The following table provides descriptions of symbols that are used on the device and/or within this manual.

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	Attention, Consult Accompanying Documents / Refer to Manual		Type BF Equipment
	Low priority message		Alarm Icon
	Medium priority message		Alarm Mute Icon
	High priority message		Full Battery Indicator
	Equipotentiality		Low Battery Indicator
	Alternating Current (AC)		Internal Battery
	Protective Earth (Ground)		Latex-free product
	Fuse		Interference may occur in the vicinity of equipment marked with this symbol
	Catalog Number		Plug Icon
	Serial Number		Date Code
	Lock		Recycle
	Unlock		Separate treatment from general waste at end of life

1.0 *Product Description*

FIGURE 1-1 The **AS3000** Anesthesia Delivery System

1.1 General System Overview

The **AS3000** is a continuous flow anesthesia system which offers manual or automatic ventilation, easily adjustable fresh gas delivery, anesthetic agent delivery, ventilation monitoring, convenient ergonomics, and state-of-the-art safety systems.

1.1.1 Anesthesia Ventilator

The **AS3000** ventilator offers multiple ventilation modes: Controlled Mandatory Ventilation with volume control (CMV), Pressure Control Ventilation (PCV), Synchronized Intermittent Mandatory Ventilation (SIMV), and Pressure Support (PS) ventilation. Electronic PEEP is available in all ventilation modes. User control over inspiratory flow (SLOPE) is possible in PCV, SIMV, and PS modes. Automatic fresh gas compensation limits the effect on the patient of user changes in fresh gas flow rate. The traditional bellows system is driven by oxygen and makes patient disconnections clearly visible.

1.1.2 Fresh Gas Dosing

The **AS3000** fresh gas dosing subsystem offers the following features:

- Dual-flow tubes (backlit for dark room viewing) to display the O_2, N_2O, and Air flows at all times
- A knob guard to prevent inadvertent movement of the flow control knobs
- Gas supply gauges to indicate the gas pipeline supply pressures and gas cylinder pressures
- An auxiliary O_2 flow meter
- An auxiliary Air flow meter
- An O_2 flush button

Safety systems within the **AS3000** work to prevent hypoxic mixtures from being delivered to the patient. Nitrous oxide will not be delivered unless oxygen pressure is present. A mechanical safety system assures that at least 21% O_2 is present when setting mixtures of O_2 and N_2O.

WARNING: Ensure that both O_2 and N_2O flow controllers are turned OFF fully at the start and at the end of each case.

All **AS3000** units noted with Model No. 0998-00-3024-02 are designed to maintain a safe O_2:N_2O ratio by allowing nitrous oxide to be set to a flow rate that is proportional to a previously adjusted flow of oxygen. The N_2O flow is limited by the flow of O_2 so that a safe ratio of no less than 21% oxygen can be maintained. This version is designed to maintain oxygen flow at its previously set level when N_2O is decreased.

When the user is adjusting N_2O and O_2 flow rates, always adjust the oxygen flow first to enable the nitrous oxide flow. To add N_2O to the fresh gas flow, the user must fully open the N_2O flowmeter valve, but only after opening the O_2 flowmeter valve.

All **AS3000** units noted with Model No. 0998-00-3024-01 maintain a safe O_2:N_2O ratio by adding O_2 flow as the user increases the N_2O flow. This version is not designed to maintain oxygen flow at the highest flow level achieved when nitrous oxide is decreased.

For **AS3000** models noted with Model No. 0998-00-3024-01, the user can avoid redundant steps when adjusting N_2O and O_2 by always adjusting the O_2 flow after adjusting N_2O flow. This will assure that the desired oxygen flow is achieved.

1.1.3 Vaporizer Mounting

The **AS3000** contains a 2-position Selectatec type vaporizer mounting system. Lighting incorporated above the vaporizers enables them to be seen in a darkened environment.

1.1.4 Breathing System

The **AS3000** breathing system is heated to minimize condensation inside the block and to return the patient's moisture. The breathing system provides access to the APL valve and breathing bag along with a view of the mechanical breathing pressure gauge. The APL valve has a single turn knob that provides a clear view of the manual breathing pressure setting. The absorber assembly incorporates a cam lock device that opens and closes to provide access to the absorber canisters. CO_2 absorbent pre-paks or loose fill can be used (see Chapter 4, Accessories). A water trap that can be drained is also provided on the absorber assembly.

Two (2) flow sensors in the breathing system measure inspired and exhaled gases for control and monitoring. Spirometry is standard. Inspired oxygen concentration is monitored via a fuel-cell type sensor and breathing pressure is also monitored. The breathing system can be swiveled for ease of positioning. A test plug is provided between the two main hose connections to allow for automated leak testing during startup. Connection to the Anesthesia Gas Scavenging System (AGSS) is made from the bottom rear of the breathing system.

1.1.5 Power Management

The advanced power management system of the **AS3000** provides AC power for its main system functions while also charging its internal batteries. In the case of an AC power failure, the **AS3000** will operate for a minimum of 45 minutes on battery power. A recessed main switch is provided to power the system ON and OFF.

The four (4) auxiliary AC outlets provided on the rear of the machine operate independent of the main switch position.

1.1.6 Workplace Ergonomics

The **AS3000** is a full-featured anesthesia delivery work station. The raised perimeter of its stainless steel work surface controls items that might otherwise roll or slide off its edge. The work surface light has high and low brightness settings. Its wrap-around handle enables fine positioning of the machine. Three (3) large drawers are available for storage. The top drawer is lockable with a key. Rail mounts are provided on both sides of the machine to enable positioning of system elements and mounting of patient monitors and most standard attachment arms for other devices. A non-slip footrest and brakes for the front wheels are provided. The top shelf can be used for additional equipment.

1.2 Responsibilities of Operators

The proper function of the **AS3000** system can only be guaranteed if it is operated and serviced in accordance with the information provided in this manual and the **AS3000** Service Manual. Non-compliance with this information voids all guarantee claims.

NOTE: **This manual only describes the operation of the machine. Information about service and repair is contained in the AS3000 Service Manual.**

The machine must be operated by qualified and trained personnel only. All operators must fully observe these operating instructions and relevant additional documentation. They must also comply with the WARNINGS and CAUTIONS detailed in this manual.

1.3 Key Features

FEATURE	DESCRIPTION
Display	10.4 inch color liquid crystal display
Navigation	Hard keys and Navigator™ Knob for easy navigation
Ventilation	Multiple advanced modes of ventilation: CMV, PCV, SIMV, PS
Fresh Gas Delivery	Dual Flow Tubes for ease of use 3 cylinder mount locations on rear
Breathing System	Heated, adjustable swivel, front hose ports, single turn APL valve
Work Surface	Large stainless steel Additional Rail mount extended work surface
Electronic PEEP	Positive End Expiratory Pressure (PEEP) is set and controlled electronically.
Clear Data Display	2 large waveforms for pressure and volume or Spirometry Loops - standard

1.4 User Interface

The **Display** of the User Interface (described in section 1.4.1) provides waveforms, numeric data and menu tabs. The keys and Navigator™ Knob of the **Keypad Area** (described in section 1.4.2) enable the user to power up the system, silence alarms, access menu tabs, and switch between manual and mechanical ventilation. The following figure is an example of the User Interface with the display during system power-up.

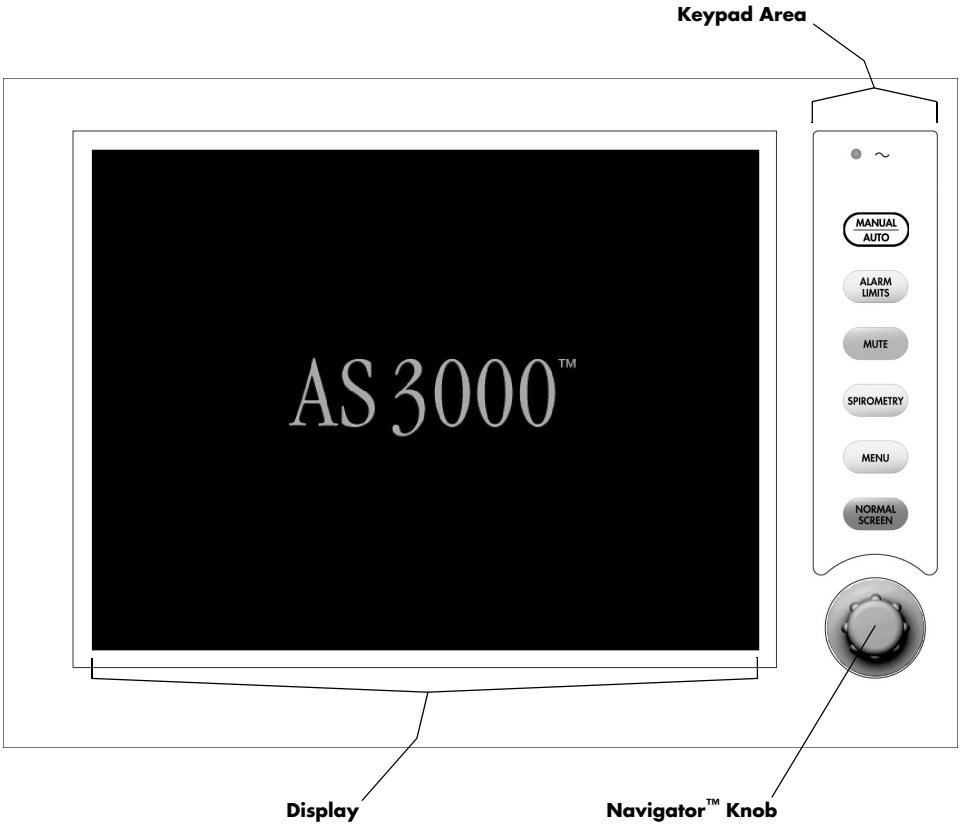


FIGURE 1-2 Example of the User Interface with the display during system power-up

1.4.1 Display

FIGURE 1-3 and the descriptions that follow provide an overview of the **Display**.

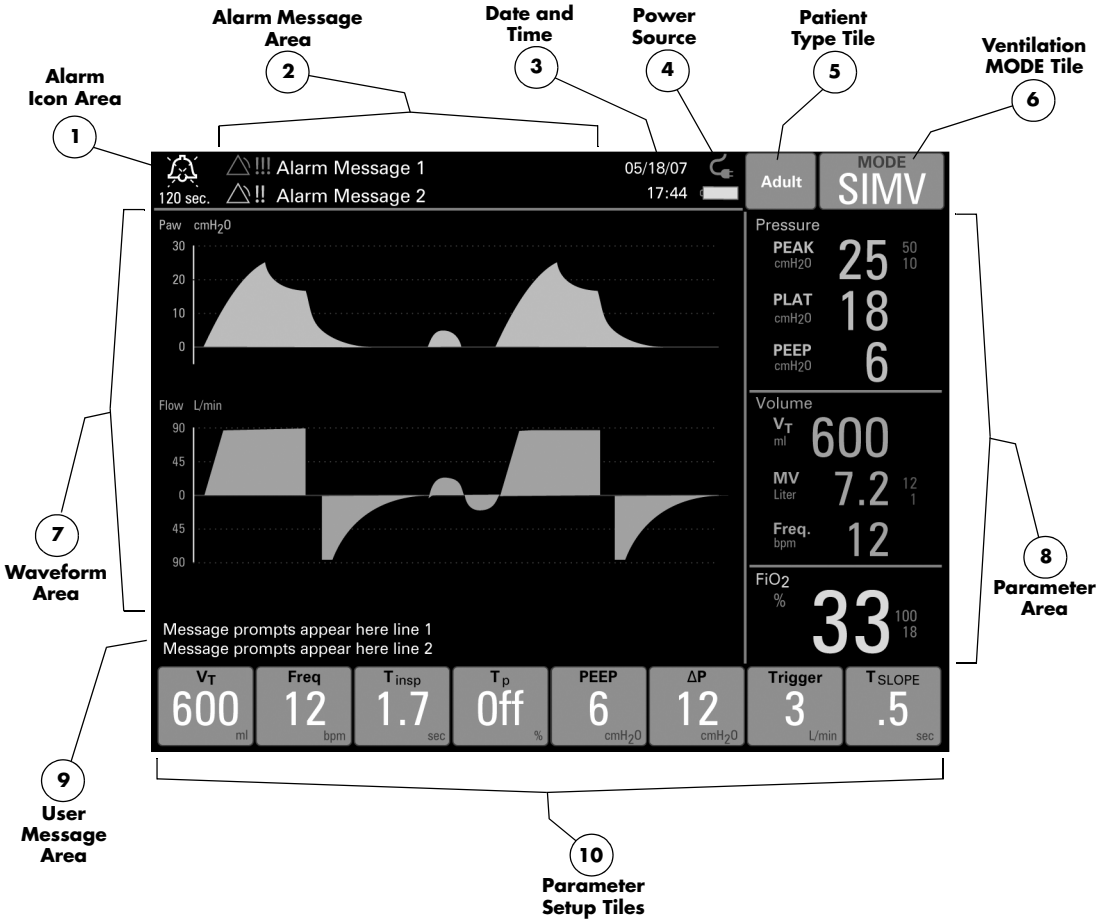


FIGURE 1-3 Display

1. Alarm Icon Area

When any parameter enters an alarm state, an **Alarm Icon** is displayed in this area. Pressing the **MUTE** key displays an **Alarm Mute Icon** in this area with a 120 second countdown timer. (See item 4 in section 1.4.2 for a complete description of the **MUTE** key.)

2. Alarm Message Area

Technical messages and functional alarm messages are displayed in this area. See sections 2.12.3.1 and 2.12.3.2 for table listings of the individual messages and their associated priority levels. High priority messages are red. Medium and low priority messages are yellow. Up to 2 messages can be displayed in this area.

3. Date and Time

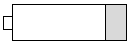
From the **Date** sub-menu of the **System** menu tab, the date can be configured to display in one of the following formats: MM/DD/YY, DD/MM/YY or YY/MM/DD. The default format is MM/DD/YY. From the **Time** sub-menu of the **System** menu tab, the time can be adjusted and configured to display in 12-hour or 24-hour format. The default format is 12-hour.

4. Power Source

A Plug Icon and Battery Indicator are always present and will illuminate as follows:

Plug Icon

While the system is functioning on AC power, the plug icon is constantly illuminated. During battery operation, the plug icon flashes.

Battery Indicator **Full Battery**  **Low Battery**

When batteries are installed and the system is functioning on battery power, the battery indicator provides a visual reference for the approximate charge level of the batteries.

5. Patient Type Tile

NOTE: The ventilation mode must be set to STANDBY in order to change the patient type. The default patient type on power-up is Adult.

Rotating the Navigator™ Knob to this tile highlights the current setting. Pressing the Navigator™ Knob while this tile is highlighted will toggle the patient type between **Adult** and **Child**.

6. Ventilation MODE Tile

NOTE: STANDBY is the default ventilation mode at startup.

During normal operation, this tile displays the current ventilation mode. It is also used to choose a different ventilation mode. Press the Navigator™ Knob while this tile is highlighted and rotate the knob in either direction to scroll through the following ventilation modes: STANDBY, MANUAL, CMV, PCV, SIMV, and PS.

When the desired mode is displayed, press the Navigator™ Knob to select it. The tile will flash to indicate that a new mode is pending. The parameter setup tiles associated with the selected ventilation mode will be displayed. Before activating the new mode (i.e. while the new mode is pending), the Navigator™ Knob can be used to adjust each associated parameter. (See item 10 in this section for descriptions of the parameter setup tiles and how to adjust settings.)

NOTE: A message will be displayed in the user message area to indicate that the displayed parameter values are for the pending ventilation mode.

With all parameters set, rotate the Navigator™ Knob back to the ventilation **MODE** tile and press the knob to activate the new ventilation mode.

NOTE: If the new ventilation mode has not yet been activated and the Navigator™ Knob is not pressed or rotated for 15 seconds, a time-out will occur, causing the display to revert back to the previous mode and its associated parameters.

7. Waveform Area

One of the following three waveform configurations will be displayed in this area:

- Pressure vs. Time and Flow vs. Time waveforms (see the example in FIGURE 2-14)
- Pressure-Volume Spirometry Loop (see the example in FIGURE 2-15)
- Flow-Volume Spirometry Loop (see the example in FIGURE 2-16)

The default waveform configuration is Pressure vs. Time and Flow vs. Time.

NOTE: When in STANDBY ventilation mode, the X and Y-axes for Pressure vs. Time and Flow vs. Time are displayed, but the waveforms are inactive.

8. Parameter Area

Patient parameters are displayed in this area in the following 3 parameter groups:

- Pressure (see section 2.11.1)
- Volume (see section 2.11.2)
- FiO_2 (Inspired O_2) (see section 2.11.3)

9. User Message Area

The following user messages are displayed in this area:

MESSAGE	REASON
Displayed parameter values are for the pending mode!	The ventilation **MODE** tile is flashing.
Ventilator setting is not possible!	The attempted parameter setting is not possible.
Pressure, Volume and Apnea Alarms are OFF.	Alarms have been turned off in MANUAL mode.
Automatic Ventilation not available!	During the initial power-up System Self Test, failures have been encountered with the PEEP valve, Inspiratory sensor or Inspiratory valve.
Current ventilation mode is xxx.	Indicates the current ventilation mode when the ventilation mode tile is flashing.

10. Parameter Setup Tiles

The eight (8) parameter setup tiles are used to display and adjust the parameter settings. Pressing the Navigator™ Knob when a parameter setup tile is highlighted selects the tile for setting adjustment. Rotating the Navigator™ Knob clockwise will increase the setting and rotating it counterclockwise will decrease the setting. The range of settings for each parameter has a maximum and minimum value.

NOTE: If setting adjustments have not yet been accepted, and the Navigator™ Knob is not pressed or rotated for 15 seconds, a time-out will occur, causing the display to revert back to the previous settings.

The layout of the parameter setup tiles varies with the chosen ventilation mode as indicated in the following table:

	VENTILATION MODE					
	STANDBY	**CMV**	**PCV**	**SIMV**	**PS**	**MANUAL**
Tile #1	Blank	V_T	P_{TARGET}	V_T	Blank	Blank
Tile #2	Blank	Freq	Freq	Freq	$Freq_{MIN}$	Blank
Tile #3	Blank	I:E	I:E	T_{INSP}	Blank	Blank
Tile #4	Blank	T_P	Blank	T_P	Blank	Blank
Tile #5	Blank	PEEP	PEEP	PEEP	PEEP	Blank
Tile #6	Blank	Blank	Blank	ΔP	ΔP	Blank
Tile #7	Blank	Blank	Blank	Trigger	Trigger	Blank
Tile #8	Blank	Blank	T_{SLOPE}	T_{SLOPE}	T_{SLOPE}	ALARM

a. V_T (Tidal Volume) – The **V_T** unit of measure is **ml** and it has separate default settings for the Adult and Child patient types.

- The range of settings for the Adult patient type is 40 to 1400 ml, in increments of 10 ml and its default is 600 ml.
- The range of settings for the Child patient type is 40 to 1400 ml, in increments of 10 ml and its default is 120 ml.

NOTE: This parameter is available in the CMV and SIMV with PS ventilation modes.

b. Freq (Frequency) – The **Freq** unit of measure is **bpm**. It has separate default settings for the Adult and Child patient types that vary depending on the chosen ventilation mode as follows:

CMV and PCV

- The range of settings for the Adult patient type is 4 to 60 bpm, in increments of 1 bpm and its default is 8 bpm.
- The range of settings for the Child patient type is 4 to 60 bpm, in increments of 1 bpm and its default is 20 bpm.

SIMV with PS

- The range of settings for the Adult patient type is 2 to 60 bpm, in increments of 1 bpm and its default is 4 bpm.
- The range of settings for the Child patient type is 2 to 60 bpm, in increments of 1 bpm and its default is 4 bpm.

c. I:E (Ratio of Inspiratory Time to Expiratory Time) – The **I:E** ratio does not have a unit of measure. The range of settings for both the Adult and Child patient types is 4:1 to 1:5, in increments of 0.5 and its default is 1:2.

NOTE: This parameter is available in the CMV and PCV ventilation modes.

d. T_{INSP} (Inspiratory Time) – The **T_{INSP}** unit of measure is **sec** and it has separate settings for the Adult and Child patient types.

- The range of settings for the Adult patient type is 0.2 to 5.0 seconds, in increments of 0.1 seconds and its default is 2 seconds.
- The range of settings for the Child patient type is 0.2 to 5.0 seconds, in increments of 0.1 seconds and its default is 1 second.

NOTE: This parameter is available in the SIMV with PS ventilation mode only.

e. PEEP (Positive End-Expiratory Pressure) – The **PEEP** unit of measure is **cmH_2O**. The range of settings for both the Adult and Child patient types is Off and 3 to 30 cmH_2O, in increments of 1 cmH_2O. Its default is Off.

NOTE: This parameter is available in the CMV, PCV, SIMV with PS, and PS ventilation modes.

f. $Freq_{MIN}$ (Frequency Min) – The **$Freq_{MIN}$** unit of measure is **bpm** and it has separate settings for the Adult and Child patient types.

- The range of settings for the Adult patient type is 2 to 60 bpm, in increments of 1 bpm and its default is 2 bpm.
- The range of settings for the Child patient type is 2 to 60 bpm, in increments of 1 bpm and its default is 4 bpm.

NOTE: This parameter is available in the PS ventilation mode only.

g. T_P (Inspiratory Pause) – The **T_P** unit of measure is **%**. The range of settings for both the Adult and Child patient types is Off and 5 to 60%, in increments of 5%. Its default is 10%.

NOTE: This parameter is available in the CMV and SIMV with PS ventilation modes.

h. Trigger (Flow Trigger) – The **Trigger** unit of measure is **L/min** and it has separate settings for the Adult and Child patient types.

- The range of settings for the Adult patient type is 1 to 15 L/min, in increments of 1 L/min and its default is 3 L/min.
- The range of settings for the Child patient type is 1 to 15 L/min, in increments of 1 L/min and its default is 2 L/min.

NOTE: This parameter is available in the SIMV with PS and PS ventilation modes.

i. P_{TARGET} (Target Pressure) – The **P_{TARGET}** unit of measure is **cmH_2O**. The range of settings for both the Adult and Child patient types is 5 to 70 cmH_2O, in increments of 1 cmH_2O. The default for the Adult patient type is 20 cmH_2O. The default for the Child patient type is 10 cmH_2O.

NOTE: This parameter is available in the PCV ventilation mode only.

j. ΔP (Differential Target Pressure) – The **ΔP** unit of measure is **cmH_2O**. The range of settings for both the Adult and Child patient types is 3 to 50 cmH_2O, in increments of 1 cmH_2O. The default for the Adult patient type is 5 cmH_2O. The default for the Child patient type is 5 cmH_2O.

NOTE: This parameter is available in the SIMV with PS and PS ventilation modes.

k. T_{SLOPE} (Inspiratory Slope) – The **T_{SLOPE}** unit of measure is **sec**. The range of settings for both the Adult and Child patient types is 0 to 2 seconds, in increments of 0.1 seconds. Its default is 0.5 seconds.

NOTE: This parameter is available in the PCV, SIMV with PS, and PS ventilation modes.

1.4.2 Keypad Area

The following provides a brief explanation of the components of the **Keypad Area** (shown in FIGURE 1-4).

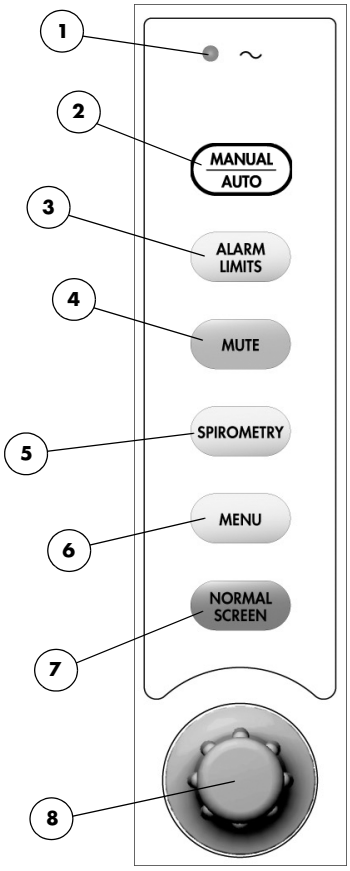


FIGURE 1-4 Keypad Area

1. AC Power LED

A green LED that is used to indicate that the unit is connected to the AC Power within the facility.

2. MANUAL/AUTO key

Press this key to change the current ventilation mode to manual mode. Each successive key press will toggle between manual mode and the previously selected ventilation mode.

3. ALARM LIMITS key

Press this key to open the **Alarm** menu tab. If the **Alarm** menu tab is already open when the **ALARM LIMITS** key is pressed again, the **Alarm** menu tab will close.

4. MUTE key

Press this key to mute (silence) audio alarm tones for all currently alarming parameters for 120 seconds or until the alarm conditions are no longer present. Any new alarms that occur while the alarm tone is muted will disable the mute and sound the new alarm tone. While the alarms are muted, an Alarm Mute icon with a 120 second countdown timer is presented in the upper left corner of the display.

5. SPIROMETRY key

This key toggles the waveform area between the Pressure vs. Time and Flow vs. Time waveforms and the two (2) loop display configurations of the **Spirometry Loop Window** described in section 2.11.

The first key press displays the "Pressure-Volume" loop display configuration. The second key press displays the "Flow-Volume" loop display configuration. After both configurations have been cycled through the display, a third key press returns the display to the Pressure vs. Time and Flow vs. Time waveforms.

6. **MENU** key

This key toggles the waveform area between the currently displayed waveform(s) and the menu tabs.

The first key press after initial power-up opens the **Calibrate** menu tab with the **Start Calibration** button highlighted. From the currently displayed waveform(s), subsequent pressing of the **MENU** key opens the last viewed menu tab. If a menu tab is already open when the **MENU** key is pressed, that menu tab will close, returning the waveform area to the currently displayed waveform(s).

7. **NORMAL SCREEN** key

Press this key at any time to return the display to the normal operating mode. All menu tabs are closed.

8. Navigator™ Knob

Rotate this knob to highlight the various tiles or menu tabs on the display. Press the center of the knob to select a highlighted item.

NOTE: **If a change of setting (Ventilation Mode, Patient Type, Ventilation Parameter, Alarm Limit or System Setting) is in process, and any key except MUTE is pressed prior to confirming that change, the system will revert back to the previously confirmed setting.**

1.5 Front View

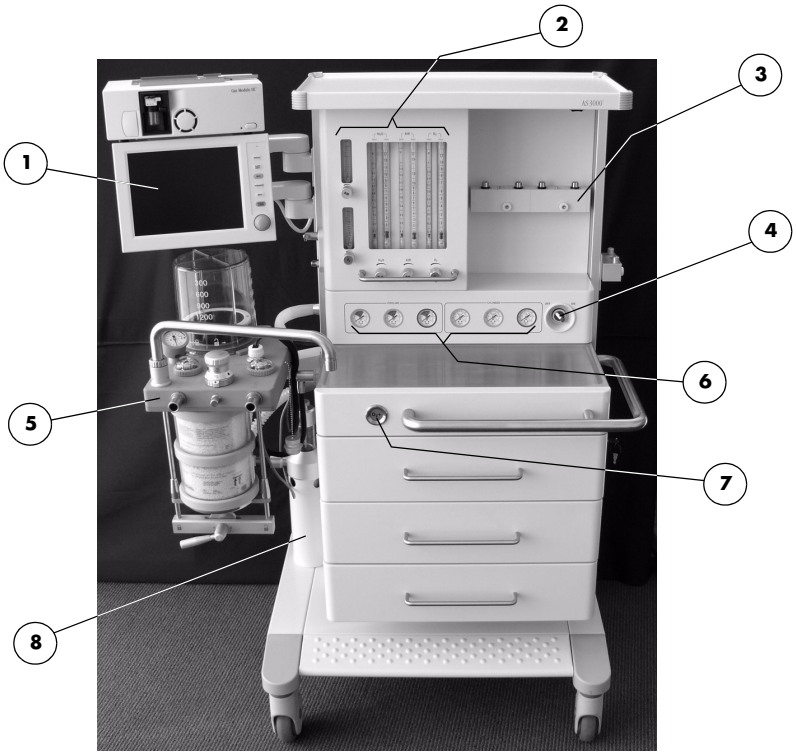


FIGURE 1-5 Front View

PART(S)	DESCRIPTION
1. User Interface	See section 1.4.
2. Auxiliary Outputs/ Fresh Gas Dosing Components	See section 1.6.
3. Vaporizer Mounting Manifold	An interface for 2 Selectatec-type Vaporizers to mount in this location. See section 1.7.
4. Power Switch	This switch is used to turn the system ON and OFF.
5. Breathing System	Absorber circuit with integrated bag-in-bottle, active and passive valves (such as the APL valve). See section 1.8 for an in depth description.
6. Pressure Gauges	Indicate the pressure at pipeline inlets and at cylinder inlets for O_2, Air, and N_2O.
7. O_2 Flush Button	Provides high flow O_2 to the inspiratory limb of the breathing system. This button is functional regardless of whether or not the system is powered ON.
8. AGSS	Anesthetic Gas Scavenging System

1.6 Auxiliary Outputs/Fresh Gas Dosing Components

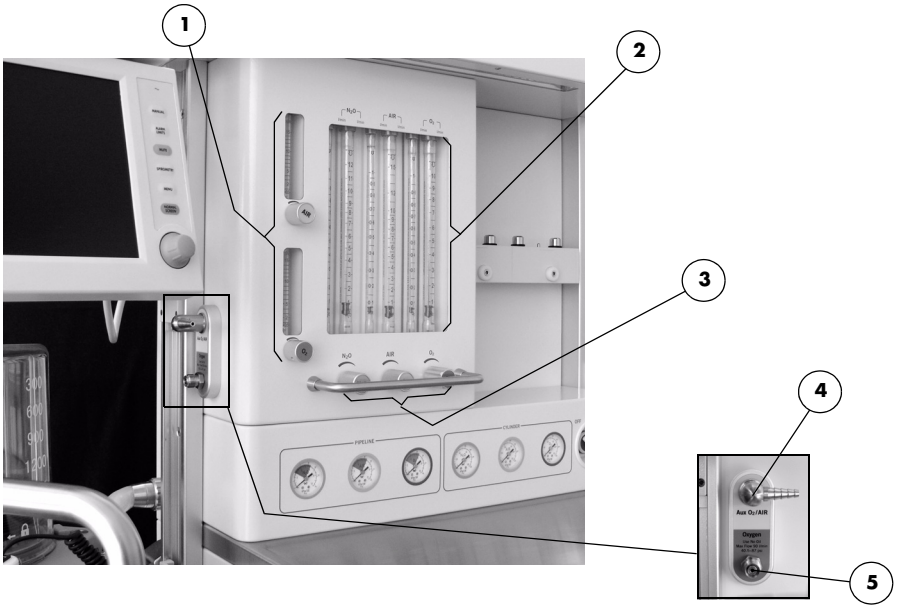


FIGURE 1-6 Auxiliary Outputs/Fresh Gas Dosing Components

PART(S)	DESCRIPTION
1. Auxiliary O_2/AIR Flowmeters	0 - 15 L/min O_2 flowmeter and 0 - 15 L/min AIR flowmeter for auxiliary O_2/AIR output.
2. Flowmeter Tubes[1]	
• N_2O Low	Low range for settings between 0.1 to 1 L/min
• N_2O High	High range for settings between 1 to 12 L/min
• AIR Low	Low range for settings between 0.1 to 1 L/min
• AIR High	High range for settings between 1 to 15 L/min
• O_2 Low	Low range for settings between 0.1 to 1 L/min
• O_2 High	High range for settings between 1 to 10 L/min
3. Flow Control Knobs[2]	
• N_2O	Gas dosing
• AIR	Gas dosing
• O_2	Gas dosing
4. Auxiliary O_2/AIR Output	Nozzle for auxiliary O_2/AIR output. Combines the auxiliary O_2/AIR flowmeters into a single output.
5. Oxygen Outlet	High pressure O_2 outlet for connecting external devices such as a jet ventilator.

1 Use the tops of the floats when reading the flowmeter tubes.
2 Turn knob counterclockwise to increase flow.

1.7 Vaporizer Mounting Manifold

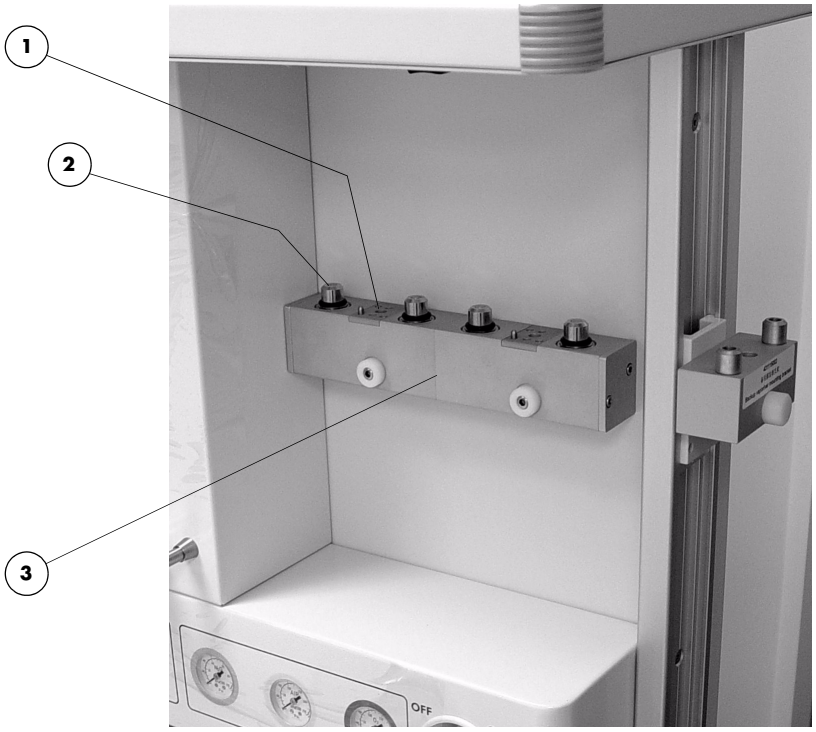


FIGURE 1-7 Vaporizer Mounting Manifold

PART(S)	DESCRIPTION
1. Locking Device	Vaporizer locking mechanism to secure against accidental disconnection.
2. Valve Cartridge of Vaporizer Mount	Vaporizer index and outlet parts.
3. Mounting Bar	Bar holds two vaporizers. An interlock within the vaporizers provides for use of one vaporizer to deliver one agent at a time.

1.8 Breathing System

1.8.1 Top View

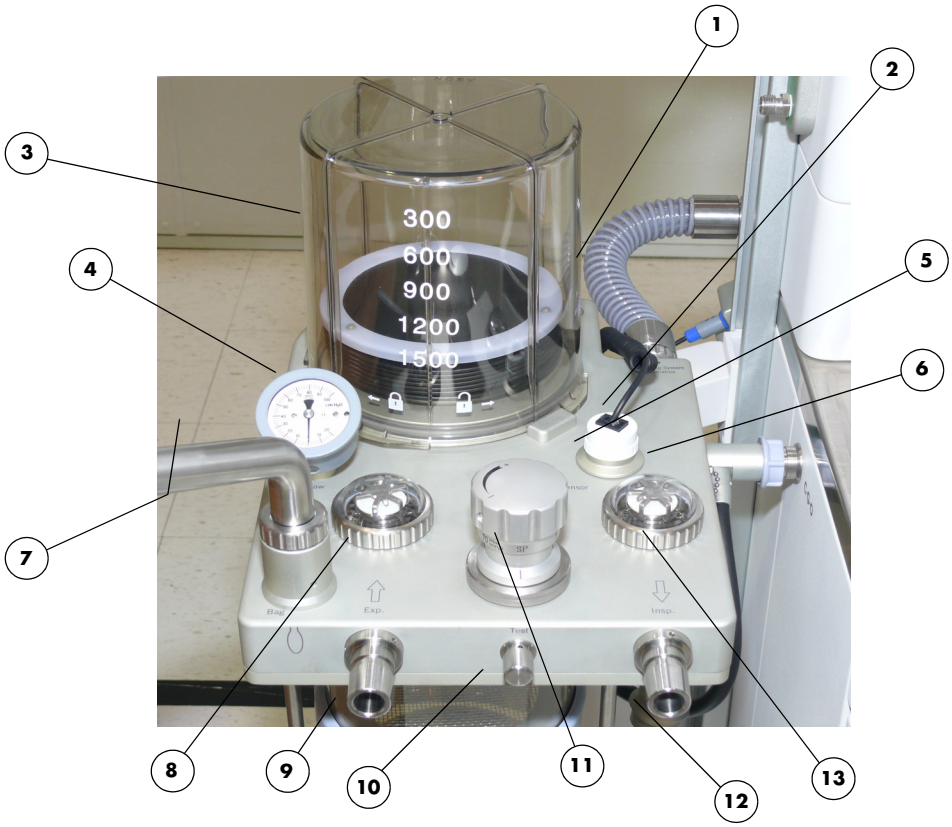


FIGURE 1-8 AS3000 Breathing System, Top View

PART(S)		DESCRIPTION
1.	Breathing System Pneumatic Hoses	Six pneumatic hoses that control the manual/vent switch and exhaust valves in the breathing system and provide the ventilator with flow sensor information.
2.	Oxygen Sensor External Cable	Connection to galvanic fuel cell
3.	Bellows (including bellows dome)[1]	Durable bellows that separates the breathing system gases from the oxygen drive gas.
4.	PAW Gauge[2]	Indicates the patient airway pressure
5.	Oxygen Sensor	Galvanic fuel cell
6.	O_2 Cell Plug	Used to seal the oxygen sensor port when it is not in use.
7.	Bag Arm	Provides the interface to the manual ventilation bag.

1 The bellows dome is a transparent cover with graduation marks from 300 to 1500. These marks are for qualitative purposes only. Tidal volume (V_T) should be read exclusively from the display of the user interface.

2 The APL valve and PAW gauge numerics are for reference only. Calibrated patient airway pressure is displayed on the user interface.

8.	Expiration Valve	Allows flow of expiratory gas from the patient to the re-breathing system.
9.	Expiratory Limb	Exhaled breathing circuit connection
10.	Y-Piece Seal	Provides a parking position to seal the breathing circuit y-piece during the compliance test.
11.	APL (Airway Pressure Limiting) Valve[2]	Rotary regulator for setting the pressure control during manual ventilation. Set to OPEN during Spontaneous breathing.
12.	Inspiratory Limb	Inhaled breathing circuit connection
13.	Inspiration Valve	Valve allows flow of inspiratory gas to the patient.

1 The bellows dome is a transparent cover with graduation marks from 300 to 1500. These marks are for qualitative purposes only. Tidal volume (V_T) should be read exclusively from the display of the user interface.

2 The APL valve and PAW gauge numerics are for reference only. Calibrated patient airway pressure is displayed on the user interface.

1.8.2 Bottom View

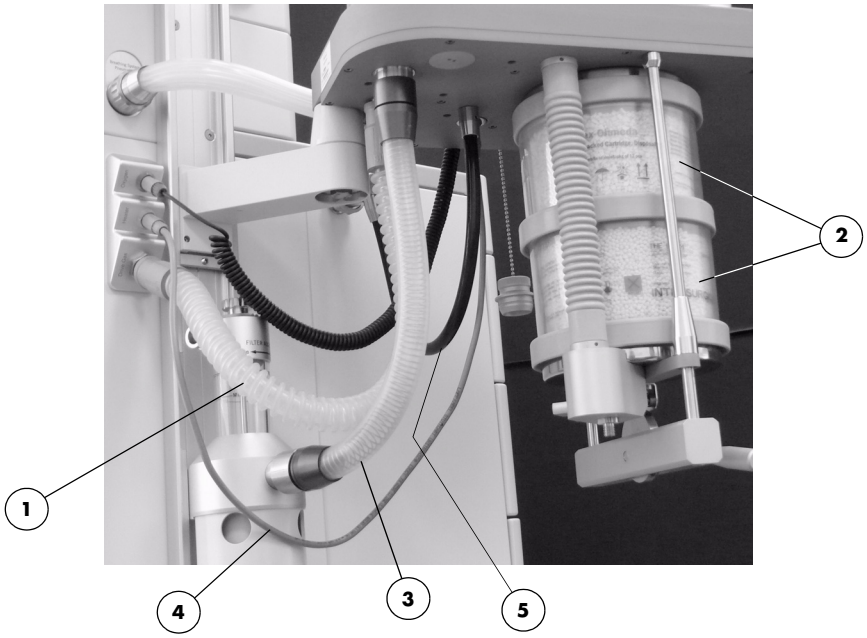


FIGURE 1-9 AS3000 Breathing System, Bottom View

PART(S)		DESCRIPTION
1.	Drive Gas Hose	Provides drive gas to the bellows.
2.	CO_2 Absorber Canisters	The two chambers hold CO_2 absorbent material (either loose fill or pre-paks).
3.	Waste Gas Hose	Hose that routes exhaust gases from the breathing system to the AGSS (Anesthetic Gas Scavenging System).
4.	Heater Wire	Provides power to the breathing system heater.
5.	Fresh Gas Hose	Provides fresh gas to the breathing system.

1.9 Rear View

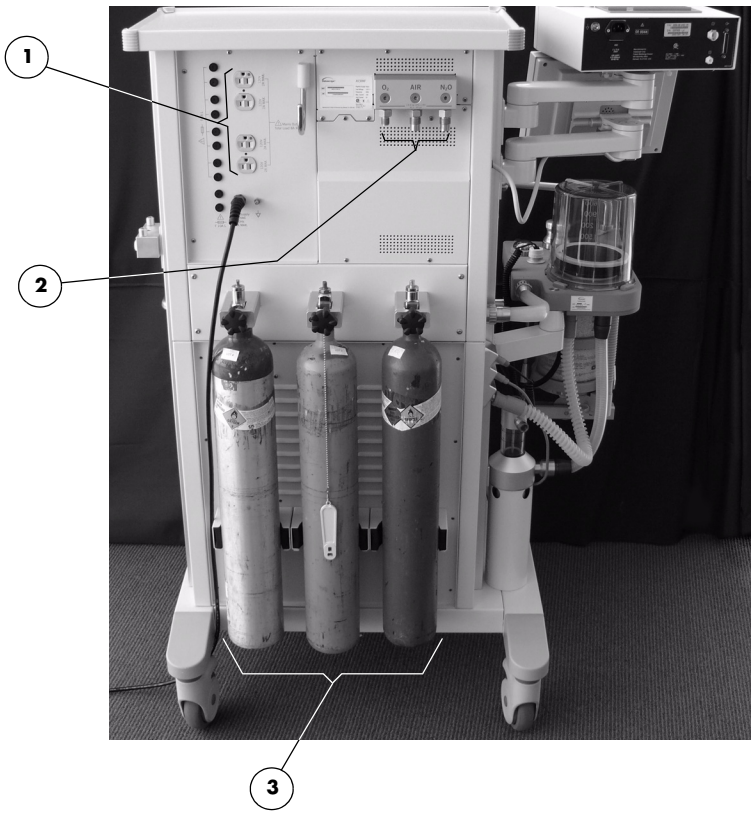


FIGURE 1-10 Rear View

PART(S)	DESCRIPTION
1. AC Outlets	Additional devices up to a total maximum power consumption of 8 amps can be connected to four outlets.
2. Gas Pipeline Supply Connections	Connections for O_2, Air, and N_2O from the central gas supply.
3. Cylinders	Supply tanks containing high pressure O_2, Air, and N_2O to act as a backup supply if the pipeline pressure is removed.

2.0 *Operations*

2.1 Getting Started

The factory default settings for waveforms, parameters, alarms, and functions enable the system to begin operation immediately upon powering up. However, all of these settings can be changed for specific patient or departmental needs.

The **AS3000** offers controlled ventilation for **Adult** and **Child** patient sizes, with default ventilation parameters and alarm related settings for each.

Select the patient size from the **Patient Type Tile** (item 5 in section 1.4.1) based on the ventilation requirements of the patient. Tube and filter systems should also be fitted to the patient.

NOTE: **Patient size should be set to match the actual patient before operating the system since certain operating characteristics are based on the selected patient size.**

The following sections outline installation, configuration, check-out, and pre-operation testing procedures. Startup procedures and other periodically performed tests and calibration steps are also provided.

2.2 Installation

After removing the machine from its shipping crate, connect the following accessories, if available, prior to preparing the machine for initial setup:

- Waste gas scavenger assembly
- Patient suction regulator

2.3 Initial Setup

The following steps must be carried out upon initial assembly or in any instance which requires disassembly of any gas machine part(s):

1. Position the machine in a location that enables the operating controls, ventilator display, and flowmeter tubes to be within easy reach.
2. Set the brakes on the casters.
3. Connect the gas supply by plugging the hose connectors into the gas supply sockets. Verify that the pressure of the gas supply is within the specifications of the machine.
4. Mount the user interface to its mounting arm and connect the cable.
5. If the breathing system has not yet been connected to the machine:
   a. Remove the transportation cover, if attached.
   b. Install the side bracket.
   c. Install the breathing system onto the side bracket.
6. Install the CO_2 absorber canisters.
7. Connect the manual ventilation bag to the bag arm on the breathing system.
8. Connect a patient breathing circuit to the inspiratory and expiratory connections.
9. Connect the waste gas hose between the bottom of the breathing system and the top of the gas scavenging system.
10. Connect the hose from the gas scavenger to the operating room's EVAC connector.
11. Connect the fresh gas hose between the bottom of the breathing system and the CGO (Common Gas Outlet) on the side of the machine.
12. Connect the heater wire between the bottom of the breathing system and the side of the machine.
13. Connect the drive gas hose between the bottom of the breathing system and the side of the machine.
14. Connect the pneumatic hoses between the side of the breathing system and the side of the machine.
15. Insert the oxygen sensor into the oxygen sensor port.
16. Connect the oxygen sensor external cable between the oxygen sensor and the side of the machine.
17. Plug the mains cable into a grounded socket and switch on the power supply using the mains switch (located on the front of the machine). Wait until the ventilator display provides information about the leak test.

2.4 Preoperative Checkout

This checkout should be conducted before administering anesthesia. Refer to special procedures or precautions in this manual.

NOTE: This is a guideline which can be modified to accommodate variations in local clinical practice. Such local modifications should have appropriate peer review.

If an anesthetist uses the same machine in successive cases, this checkout need not be repeated or may be abbreviated after the initial checkout.

1. Inspect the system for:
   - **a.** Identification number
   - **b.** Valid inspection sticker
   - **c.** Damage to flowmeters, vaporizers, gauges, supply hoses
   - **d.** Complete breathing system with adequate CO_2 absorbent pre-paks or loose fill
   - **e.** Correct mounting of cylinders in yokes
   - **f.** Presence of cylinder wrench
   - **g.** Auxiliary O_2 supply, available and functioning

2. Per manufacturers' specifications, turn ON the patient monitors to allow time for their warm-up (ECG, Blood Pressure, SpO_2, Gas Monitoring, etc.).

3. Verify that self-inflating manual ventilation device is available and functioning.

4. Prepare the Anesthetic Gas Scavenging System (AGSS). Refer to section 3.1.11 for removal instructions:
   - **a.** Remove the AGSS from the **AS3000**. While viewing the float, turn the AGSS upside down to verify whether the float moves freely along its shaft. Replace the float as necessary. Reconnect the AGSS to the **AS3000**.
   - **b.** Connect the vacuum hose to the vacuum port. Adjust the position of the float to be between the **Min** and **Max** lines by turning its flow adjustment knob (counterclockwise increases flow, clockwise decreases flow).
   - **c.** Drain any moisture from the waste gas hose.Connect the waste gas hose to the AGSS waste gas port.

5. Check that:
   - **a.** Flow-control valves are off
   - **b.** Vaporizers are off
   - **c.** Vaporizers are filled (not overfilled)
   - **d.** Filler caps are sealed tightly
   - **e.** Two vaporizers cannot be turned on at the same time

6. Check oxygen (O_2) cylinder supply:
   - **a.** Disconnect pipeline supply (if connected) and return cylinder and pipeline pressure gauges to zero with O_2 flush valve.
   - **b.** Open O_2 cylinder; check pressure. A typical full cylinder pressure is 1900 psig. Replace the cylinder if its pressure is less than 1000 psig.
   - **c.** Close O_2 cylinder and observe gauge for evidence of high-pressure leak.
   - **d.** With the O_2 flush valve, flush to empty the piping.

7. Check nitrous oxide (N_2O) cylinder supply:

- **a.** Disconnect pipeline supply (if connected) and return cylinder and pipeline pressure gauges to zero with the flow control knob.
- **b.** Open N_2O cylinder; check pressure. A typical full cylinder pressure is 745 psig. Replace the cylinder if its pressure is less than 600 psig.
- **c.** Close N_2O cylinder and observe gauge for evidence of high-pressure leak.

8. Check Air cylinder supply:

- **a.** Disconnect pipeline supply (if connected) and return cylinder and pipeline pressure gauges to zero with the flow control knob.
- **b.** Open Air cylinder; check pressure. A typical full cylinder pressure is 1900 psig. Replace the cylinder if its pressure is less than 1000 psig.
- **c.** Close Air cylinder and observe gauge for evidence of high-pressure leak

9. Test Central Pipeline Gas Supplies:

- **a.** Inspect supply hoses (should not be cracked or worn).
- **b.** Connect supply hoses, verifying correct color coding.
- **c.** Adjust both O_2 and N_2O flows to at least mid-range.
- **d.** Verify that the O_2 and N_2O supply pressures hold (>50 psig).
- **e.** Shut off flow-control valves.
- **f.** Adjust the AIR flow to at least mid-range.
- **g.** Verify that the AIR supply pressure hold (>50 psig).
- **h.** Shut off flow-control valves.

10. Connect Accessories:

- **a.** Connect the breathing circuit to the corresponding ports on the breathing system.
- **b.** Connect the manual ventilation bag to the bag arm.

11. Verify that unidirectional valves are present in each limb.

12. Power up the system as described in section 2.6 and follow the on-screen prompts to perform the Leak Test and the Compliance Test.

13. Test flowmeters:

- **a.** Check that all floats are at bottom of tube with flow-control valves closed.
- **b.** Adjust flow of all gases through their full range and check for erratic movements of floats.

14. Test Hypoxic-Guard System:

- **a.** Attempt to create hypoxic O_2/ N_2O mixture by opening the N_2O flow control valve completely.
- **b.** Increase the O_2 flow and observe O_2 and N_2O rise in proportion to maintain a minimum concentration of 21% O_2 in fresh gas.

15. Test O_2 supply gas pressure failure system:

- **a.** Set O_2, N_2O, and Air gas flows to mid-range.
- **b.** Ensure that the O_2 gas cylinder is closed.
- **c.** Disconnect the O_2 supply from the **AS3000**.
- **d.** Verify that all flows, except Air, fall to zero.

e. Verify that:

- an alarm tone sounds
- the alarm message ⚠ !!! **O2 Supply Failure** is displayed in red text

f. Open the O_2 gas cylinder. Verify that the alarm tone stops and the alarm message is removed from the display.

g. Close all gas cylinders and bleed piping pressures.

h. Verify that:

- an alarm tone sounds
- the alarm message ⚠ !!! **O2 Supply Failure** is displayed in red text

i. Shut off all flow-control valves.

j. Re-connect the O_2 supply to the **AS3000**.

16. Perform High Pressure Leak Test:

a. Connect a breathing circuit and ventilation bag.

b. Set APL Valve to 70 cm H_2O.

c. Occlude Y-piece.

d. Turn O_2 flow to 50 ml/min.

e. Inflate bag with O_2 flush to 40 cm H_2O on the PAW gauge.

f. Verify that circuit holds pressure for greater than 10 seconds.

g. If vaporizers are installed, repeat steps e and f for each vaporizer while it is enabled.

h. Set the APL valve to **SP**.

17. Test Ventilator in MANUAL ventilation mode:

a. Remove the O_2 sensor and install the plug into the breathing system.

b. Set the ventilation mode to **MANUAL**.

c. Set the APL valve to **20.**

d. Set Air flow to **5 liter/minute**.

e. Squeeze the manual ventilation bag once every 10 seconds.

f. Verify that the test lung inflates and deflates to approximately 20 cm H_2O pressure.

g. Verify that peak pressure, plat pressure, PEEP, tidal volume, minute volume, and frequency values appear on screen.

h. Verify that the FiO_2 reading is approximately 21%.

i. Verify a pressure waveform appears on screen along with the bag compressions.

j. Set the APL valve to the **SP** position and stop squeezing the manual ventilation bag.

k. Re-install the O_2 sensor into the breathing system.

18. Test the CMV ventilation mode:

a. Activate the **CMV** ventilation mode.

b. Set attributes as follows:

ATTRIBUTE	SETTING
Patient Size	Adult
V_T	600
Freq	8
I:E	1:2
PEEP	Off
T_P	10
O_2 Flow	2 Liters/minute

c. Verify that the displayed Tidal Volume is within 15% of the set value within 5 breaths.

d. Verify that the O_2 display reads greater than 94 within 5 minutes.

19. Test the PCV ventilation mode:

a. Activate the **PCV** ventilation mode.

b. Set attributes as follows:

ATTRIBUTE	SETTING
Patient Size	Adult
P_{TARGET}	20
Freq	8
I:E	1:2
PEEP	Off
T_{SLOPE}	0.5
O_2 Flow	2 Liters/minute

c. Verify that the PEAK pressure settles within 20% of the set value within 5 breaths.

d. Re-activate the **CMV** ventilation mode.

20. Low FiO_2 Alarm Test

a. Press the **ALARM LIMITS** key.

b. Set the **Low** FiO_2 alarm limit to be higher than the current FiO_2 reading.

c. Verify that:

- an alarm tone sounds
- the alarm message ⚠ !!! **Low FiO2** is displayed in red text

d. Set the **Low** FiO_2 alarm limit back to 18.

21. High and Low PAW Alarm Test

a. Set the **High** PAW alarm limit to be below the current PEAK pressure reading.

b. Verify that:

- an alarm tone sounds
- the alarm message △ !!! **High Airway Pressure** is displayed in red text after several breaths
- expiration begins when the pressure limit is reached

c. Set the **High** PAW alarm limit to 50.

d. Set the **Low** PAW alarm limit to be above the current PEAK pressure reading.

e. Verify that:

- an alarm tone sounds
- the alarm message △ !! **Low Airway Pressure** is displayed in yellow text after several breaths

f. Set the **Low** PAW alarm limit to 10.

22. Low MV and APNEA Alarm Test

a. Set the **Low** MV alarm limit to the highest value.

b. Verify that:

- an alarm tone sounds
- the alarm message △ !! **Low Minute Volume** is displayed in yellow text after several breaths

c. Set the **Low** MV alarm limit to 1.

d. Press the **MANUAL**/**AUTO** key.

NOTE: **Prior to the APNEA alarm message referenced in the following step, Low Airway Pressure and Low Minute Volume alarm messages may also be displayed.**

e. After 60 seconds, verify that:

- an alarm tone sounds
- the alarm message △ !!! **APNEA** is displayed in red text

23. Place the system in **STANDBY** ventilation mode.

24. Check for appropriate level of patient suction.

25. Check, connect, and calibrate other electronic monitors.

26. Turn on and set other appropriate alarms for equipment to be used.

NOTE: **The following step should be performed every 3 days or when prompted by the machine.**

27. Perform the Oxygen Sensor Calibration as detailed in section 2.9.

NOTE: **The following step should be performed weekly or whenever a new vaporizer is installed or when CO_2 absorbent is replaced.**

28. Test for leaks in the machine and vaporizers by performing the High Pressure Leak Test as described in step 16 of this section.

2.5 Before Every Patient

- Verify that the O_2 tank is full prior to each new patient being attached to the device or when a different operator uses the gas machine.
- Check for appropriate level of patient suction.
- Verify ability of required monitors and check alarms.
- Verify CO_2 absorbent is not exhausted.
- Verify that the bellows is fully inflated before starting an automatic ventilation mode.

CAUTION: Verify that the bellows is fully inflated before starting an automatic ventilation mode on the patient. If the bellows is deflated and at the bottom of its travel at the start of an automatic ventilation mode, the bellows may become deformed.

Inflating the Bellows

On initial power-up, the bellows is automatically inflated if the Leak Test is performed. However, in between patients, if the bellows is at the bottom of its travel:

1. Install a breathing circuit and connect the Y-piece to the Test port.
2. Select CMV mode and confirm the selection.
3. Immediately push the O_2 button until the bellows is completely filled.
4. Return to STANDBY mode and remove Y-piece from Test port.

Maintaining Inflated Bellows

To prevent the bellows from deflating completely to the bottom of its travel:

- Do not disconnect the breathing circuit from the AS3000 or the patient while the ventilator is running in an automatic ventilation mode. Return to MANUAL or STANDBY modes first.
- Do not run the ventilator in an automatic ventilation mode without any fresh gas flow.
- Do not remove the absorber canister while the ventilator is running in an automatic ventilation mode. This should only be done in STANDBY mode with no patient connected.
- Do not remove the O_2 sensor or sensor adapter from the breathing system block while the ventilator is running in an automatic ventilation mode. This should only be done in STANDBY mode with no patient connected.

NOTE: If the O_2 sensor is removed when performing calibration, immediately install the plug in its place.

- Do not remove the Inspiratory/Expiratory check valve dome rings while the ventilator is running in an automatic ventilation mode. This should only be done in STANDBY mode with no patient connected.

2.6 Initial Power-Up

Turn the power switch (item 4, page 1-15) to the **ON** position. A System Self Test will be automatically initiated and will be indicated on the Display. When the self test is complete, the following message will be displayed: **Select Continue to Start Leak Test (recommended), or select Bypass to proceed to Normal screen.**

- If **Continue** is selected, follow the onscreen prompts to perform the Leak test. When the Leak test is complete, select **Continue** to proceed to the Compliance test.

NOTE: The Leak test will automatically proceed to the Compliance test if the leak rate is less than 500 mL/min

  - Follow the onscreen prompts to perform the Compliance test. When the Compliance test is complete, select **Continue** and the system will proceed to displaying the Pressure vs. Time and Flow vs. Time waveforms in STANDBY ventilation mode.
- If **Bypass** is selected, the system will skip the Leak test and the Compliance test and proceed directly to displaying the Pressure vs. Time and Flow vs. Time waveforms in STANDBY ventilation mode.

NOTE: If the Leak test result is greater than 1000 ml and the user selects MANUAL, Automatic Ventilation will be disabled.

NOTE: Bypassing the Compliance test is not recommended.

2.7 Adjusting the Date and Time

Press the **MENU** key and rotate the Navigator™ Knob until the **System** menu tab is displayed. Press the Navigator™ Knob to access the choices on the **System** menu tab.

Adjusting the Date

1. Rotate the Navigator™ Knob until **Edit Date** is highlighted and press the knob to access the **Edit Date** sub-menu.
2. Rotate and press the Navigator™ Knob as necessary to adjust the date and set the format to one of the following three (3) configurations: MM/DD/YY, DD/MM/YY or YY/MM/DD.

NOTE: The default format is MM/DD/YY.

3. Select **Done** to save the date adjustments and return to the **System** menu tab.

Adjusting the Time

1. Rotate the Navigator™ Knob until **Edit Time** is highlighted and press the knob to access the **Edit Time** sub-menu.
2. Rotate and press the Navigator™ Knob as necessary to adjust the time and set the format to either 12 Hour or 24 Hour.

NOTE: The default format is 12 Hour and the adjustable parameters are hours and minutes.

3. Select **Done** to save the time adjustments and return to the **System** menu tab.

2.8 Vaporizer Installation

WARNING: Use care in lifting and manipulating vaporizers during the mounting process as their weight may be greater than expected, based on their size and shape.

1. Align the vaporizer over the valve cartridges of the mounting bar. Hang the vaporizer on the mounting bar as shown in FIGURE 2-1. Note that the locking mechanism handle is in the unlocked position.

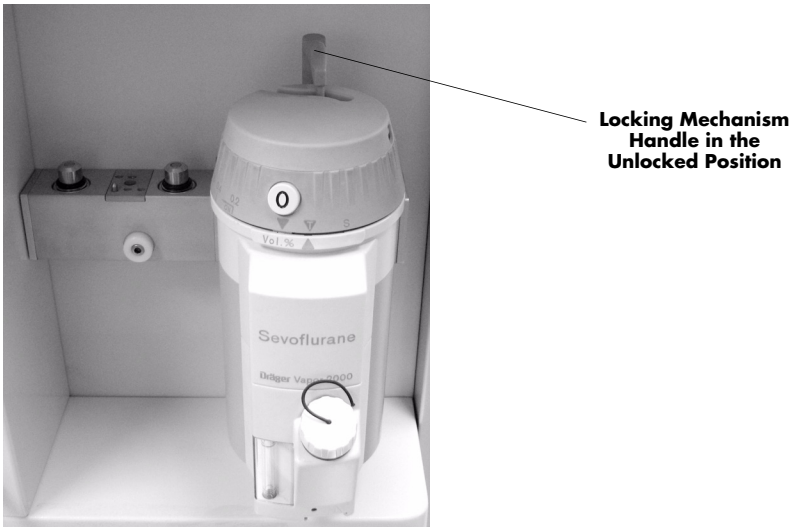


FIGURE 2-1 Vaporizer, Unlocked

2. Rotate the locking mechanism handle clockwise into the locked position as shown in FIGURE 2-2.

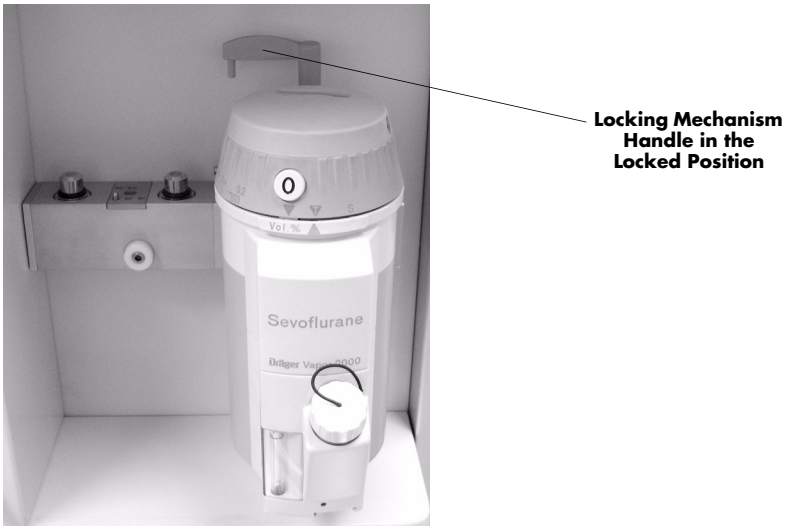


FIGURE 2-2 Vaporizer, Locked

2.9 Oxygen Sensor Calibration

NOTE: Oxygen Sensor Calibration can be performed in all ventilation modes.

1. Allow the breathing system to warm up and reach thermal equilibrium (approximately 30-60 minutes).
2. Press the **MENU** key and then use the Navigator™ Knob to scroll to the **Calibrate** menu tab (shown in FIGURE 2-3). Select the **Start Calibration** button.

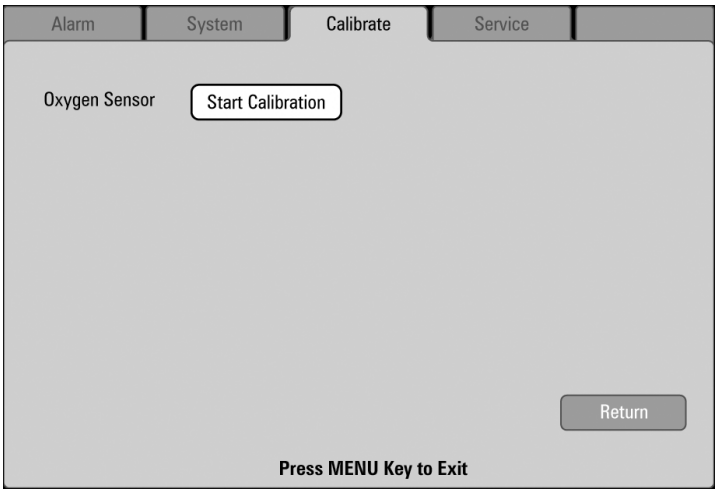


FIGURE 2-3 Calibrate Menu Tab

3. After the **Start Calibration** button has been selected, the screen shown in FIGURE 2-4 or FIGURE 2-6 will be displayed, instructing the user to remove the oxygen sensor (item 5, FIGURE 1-8) from the breathing system and expose it to room air for at least three minutes before proceeding. The O_2 sensor voltage is displayed during the calibration. This is the amplified O_2 cell voltage at the A/D converter for the oxygen sensor.

NOTE: The O_2 sensor voltage is not displayed for UI versions 2.24 and lower.

4. Flush the O_2 sensor with air from the auxiliary output for 5-10 seconds to ensure that no O_2 bubbles are trapped in the sensor.

NOTE: Do not shake the O_2 sensor during calibration.

NOTE: Keep the O_2 sensor in a vertical position, connector side up, during calibration.

NOTE: Place the O_2 sensor on top of the heated block during calibration to minimize the temperature difference from within the heated block.

NOTE: If the system is going to be used during the calibration, insert the O_2 cell plug (item 6, FIGURE 1-8) into the port from which the oxygen sensor was removed using a push and turn motion.

5. After at least three minutes have passed, select the **Next** button to initiate the calibration process. The progress bar shown in FIGURE 2-5 or FIGURE 2-7 will be displayed.

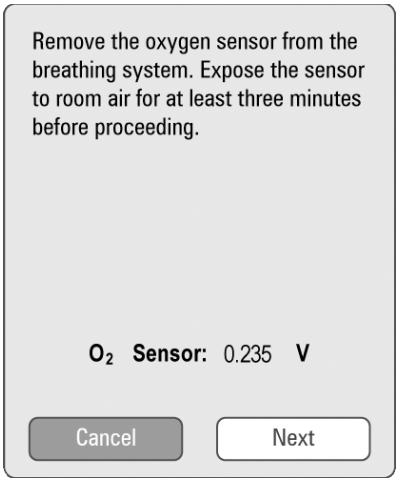

Remove the oxygen sensor from the breathing system. Expose the sensor to room air for at least three minutes before proceeding.
O2 Sensor: 0.235 V
Cancel
Next

FIGURE 2-4 Oxygen Sensor Calibration Instructions

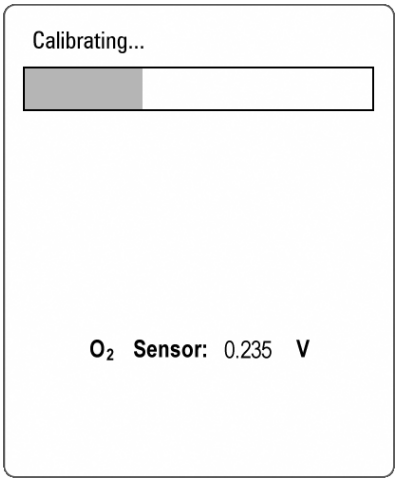


FIGURE 2-5 Oxygen Sensor Calibration Progress Bar

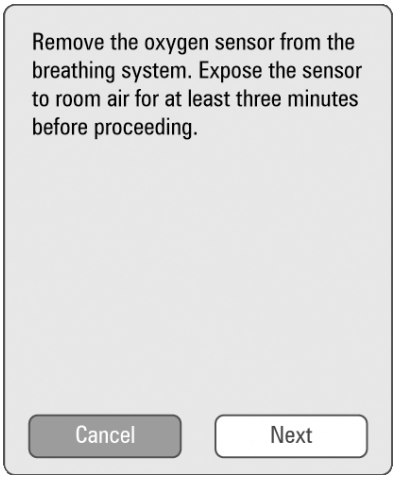

Remove the oxygen sensor from the breathing system. Expose the sensor to room air for at least three minutes before proceeding.
Cancel
Next

FIGURE 2-6 Oxygen Sensor Calibration Instructions (UI versions 2.24 and lower)

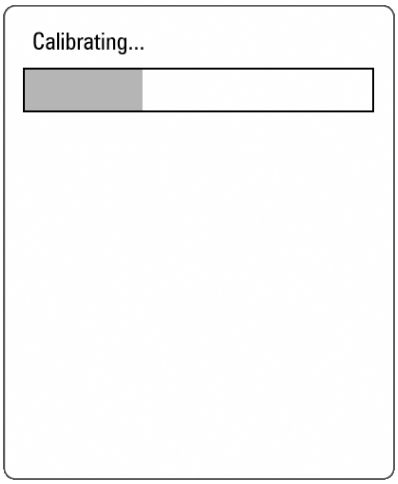


FIGURE 2-7 Oxygen Sensor Calibration Progress Bar (UI versions 2.24 and lower)

6. Proceed based on one of the following two conditions:

- **If the calibration is successful**, the screen shown in FIGURE 2-8 will be displayed, instructing the user to reinstall the oxygen sensor into the breathing system. Select the **Done** button to complete the process.
- **If the calibration fails**, the screen shown in FIGURE 2-9 will be displayed, instructing the user to either repeat the calibration (by selecting the **Repeat Cal** button) or to replace the oxygen sensor. If the oxygen sensor must be replaced, select the **Exit** button, replace the oxygen sensor, and then repeat the calibration.

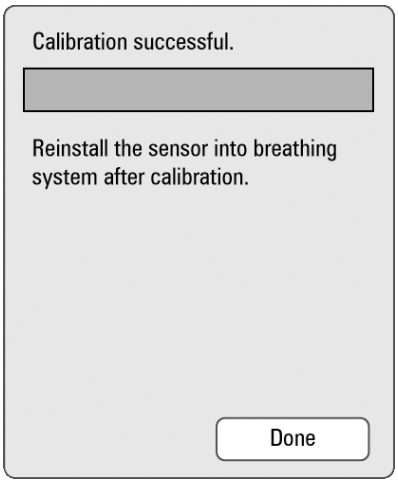


FIGURE 2-8 Oxygen Sensor Calibration Successful

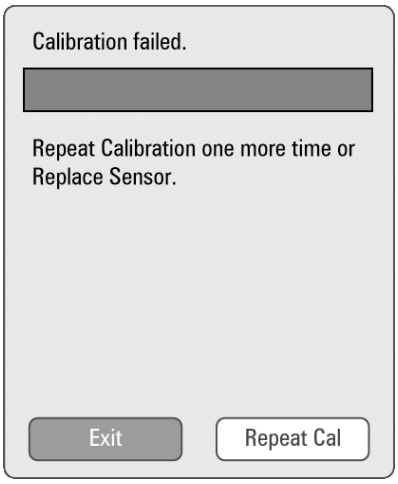


FIGURE 2-9 Oxygen Sensor Calibration Failed

2.10 Ventilation Modes

2.10.1 STANDBY

This is the operating mode in which all system functionality is idle. It is the default system startup operating mode and is used between ventilation operations.

2.10.2 MANUAL

MANUAL mode is the operating mode used for manually ventilating a patient or to let a patient breathe spontaneously. To use the manual/spontaneous ventilation mode, the user must first set the APL valve to the appropriate pressure value and then select the mode using the **MANUAL**/**AUTO** key on the User Interface or selecting **MANUAL Mode** via the Navigator Knob. Note that pressing the **MANUAL**/**AUTO** key again will put the Ventilator back into the previously selected ventilation mode.

The message "**Pressure, Volume and Apnea Alarms are OFF.**" is displayed in the lower left corner of the main screen when operating in **MANUAL Mode** with the ALARM control set to **OFF**.

Set the ALARM control to **ON** to remove this message and enable Pressure, Volume and Apnea alarms in **MANUAL Mode**.

See section 2.12.3.2 "Functional Alarm Messages" for a list of Alarm Messages

2.10.2.1 Setting the APL Valve

For Manual Ventilation

Rotate the APL valve adjustment knob to the desired pressure.

NOTE: Clockwise rotation increases the pressure, and counterclockwise rotation decreases the pressure.

The patient can be ventilated by hand using the breathing bag. The pressure will be limited to the value set on the APL valve.

For Spontaneous Breathing

Rotate the APL valve adjustment knob fully counterclockwise, until the **SP** marking on the knob lines up with the index mark on the bottom section of the valve (see item 11 in FIGURE 1-8). The valve will then be open for spontaneous patient breathing.

2.10.3 Continuous Mandatory Ventilation (CMV)

CMV mode is used to provide Continuous Mandatory Ventilation (CMV) to a patient. This is a volume mode where the user sets the desired tidal volume to be delivered to the patient's lungs and the desired frequency.

The breathing cycle is specified by the user's selection of frequency, I:E ratio, inspiratory pause time, PEEP, and tidal volume.

Compliance compensation is applied in CMV mode so that the tidal volume delivered to the patient more closely corresponds to the tidal volume setting. System compliance is determined during startup testing. To achieve the best performance, the patient hoses used during startup testing of compliance should match the hoses to be used during the procedure.

Note that in certain cases, when the ventilator is operating near its performance limits, compliance compensation will not be possible. When the **AS3000's** performance limit is reached, it will not be possible to increment the frequency setting or the tidal volume setting and the message **Ventilator setting is not possible.** will be displayed in the user message area.

See section 1.4, User Interface for detailed selection procedures and for the ranges and default values for the parameters of CMV mode ventilation. To change any parameter during CMV mode ventilation, rotate the Navigator™ Knob to the correct tile, press the knob to select that parameter, rotate the knob to change the parameter as desired, and then press the knob to confirm the new selected value.

Note that if the measured breathing pressure exceeds the Paw high alarm limit value, the ventilator will cycle to expiration to relieve that pressure.

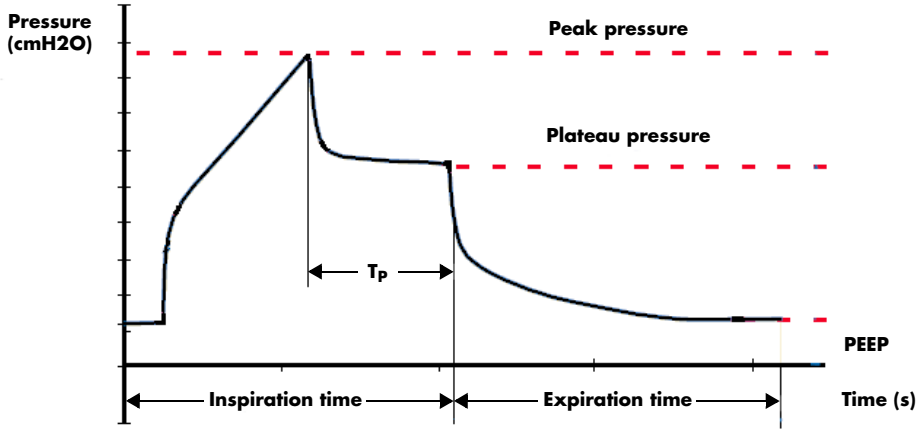


FIGURE 2-10 Typical CMV Waveform

2.10.3.1 CMV Parameter Settings

User Adjustable Parameters for CMV

- V_T (Tidal Volume)
- I:E (Ratio of Inspiratory Time to Expiratory Time)
- Freq (Frequency)
- T_P (Inspiratory Pause)
- PEEP (Positive End Expiratory Pressure)

Ranges and Delivery Accuracy for CMV

	ADULT*	**CHILD***	**DELIVERY ACCURACY**
V_T (ml)	40 - 1400 (**600**)	40 - 1400 (**120**)	Adult: ± 15% or at least 50 ml Child: ± 15% or at least 16 ml
I:E	4:1 - 1:5 (**1:2**)	4:1 - 1:5 (**1:2**)	Times of phases is ± 35%
Freq (bpm)	4 - 60 (**8**)	4 - 60 (**20**)	± 1
T_P (%)	Off, 5 - 60 (**10**)	Off, 5 - 60 (**10**)	± 30%
PEEP (cmH_2O)	Off, 3 - 30 (**Off**)	Off, 3 - 30 (**Off**)	3 - 12 cmH_2O (± 2 cmH_2O) 13 - 17 cmH_2O (± 3 cmH_2O) 18 - 24 cmH_2O (± 6 cmH_2O) 25 - 30 cmH_2O (± 12 cmH_2O)

* *Defaults appear in parenthesis in bold text.*

2.10.4 Pressure Controlled Ventilation (PCV)

PCV mode is used to provide Pressure Controlled Ventilation (PCV) to the patient. In PCV, the patient receives breaths with a fixed pressure limit and frequency. A continuous pressure is presented to the patient's airway during the inspiratory time (T_{INSP}). The rise time of the pressure waveform is controlled by the setting of T_{SLOPE}.

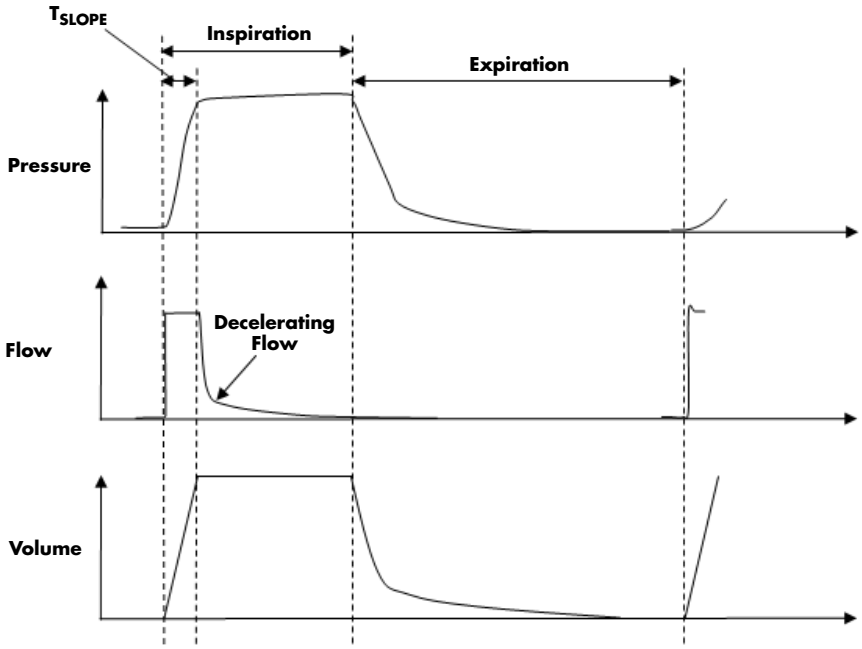


FIGURE 2-11 Typical PCV Waveform

Definitions

TRIGGER METHOD	FLOW TRIGGERED
PEEP setting	PEEP is at least 5 cmH_2O below target pressure.
Inspiratory flow setting	The user sets the time T_{SLOPE} required to reach the set ΔP. The ventilator regulates the inspiratory flow to match the T_{SLOPE} time set by the user.
Inspiratory time	The set T_{SLOPE} time will not be greater than the time resulting from the set I:E ratio and frequency. In case of conflict, the set I:E ratio and frequency will override the set T_{SLOPE} time.

2.10.4.1 PCV Parameter Settings

User Adjustable Parameters for PCV

- P_{TARGET} (Target Pressure)
- I:E (Ratio of Inspiratory Time to Expiratory Time)
- Freq (Frequency)
- T_{SLOPE} (Inspiratory Slope)
- PEEP (Positive End Expiratory Pressure)

Ranges and Delivery Accuracy for PCV

	ADULT*	**CHILD***	**DELIVERY ACCURACY**
P_{TARGET} (cmH_2O)	5 - 70 (**20**)	5 - 70 (**10**)	5 - 29 (± 3 cmH_2O), 30 - 70 (± 7 cmH_2O)
I:E	4:1 - 1:5 (**1:2**)	4:1 - 1:5 (**1:2**)	Times of phases is ± 35%
Freq (bpm)	4 - 60 (**8**)	4 - 60 (**20**)	± 1
T_{SLOPE} (sec)	0 - 2 (**0.5**)	0 - 2 (**0.5**)	± 1.0 sec
PEEP (cmH_2O)	Off, 3 - 30 (**Off**)	Off, 3 - 30 (**Off**)	3 - 12 cmH_2O (± 2 cmH_2O) 13 - 17 cmH_2O (± 3 cmH_2O) 18 - 24 cmH_2O (± 6 cmH_2O) 25 - 30 cmH_2O (± 12 cmH_2O)

* *Defaults appear in parenthesis in bold text.*

2.10.5 Synchronized Intermittent Mandatory Ventilation (SIMV)

SIMV mode provides Synchronized Intermittent Mandatory Ventilation (SIMV) to the patient as well as the capability for Pressure Supported (PS) spontaneous breathing between needed mandatory breaths. SIMV in the **AS3000** is a volume mode where the user can set the tidal volume, frequency, inspiratory pause, PEEP, and inspiratory time. Mandatory breaths are synchronized with the patient's inspiratory effort.

NOTE: The PS (Pressure Support) function within SIMV operates as described in the next section.

SIMV mode enables the patient to breath spontaneously with or without pressure support between mandatory breaths. If no inspiratory effort is detected, the **AS3000** delivers a mandatory breath per the set rate.

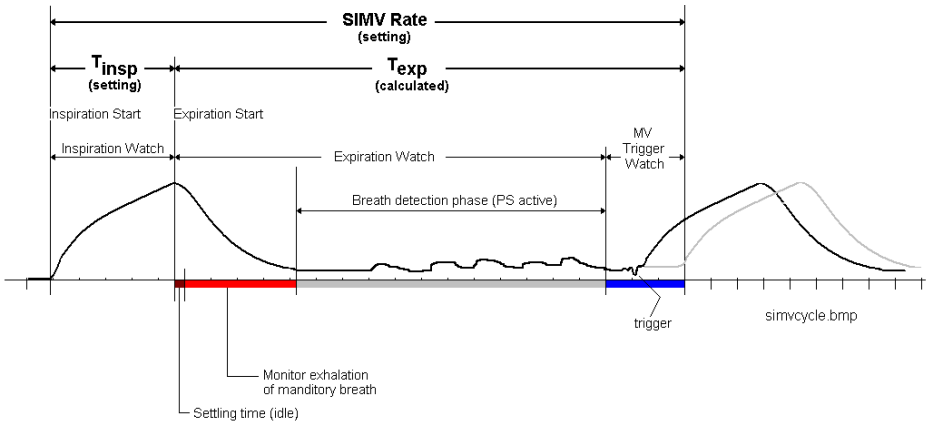


FIGURE 2-12 Typical SIMV Waveform

Definitions

TRIGGER METHOD	FLOW TRIGGERED
Ventilation end (start of breath detection phase)	Expiratory flow reaches a threshold value near 0.
"SIMV breath" trigger window	25% of expiration time
Pressure support end	Inspiratory flow reaches 25% of the maximum value. Timeout after 3 seconds.
Set pressure support target pressure	The set target pressure for the pressure support is a differential pressure value (ΔP).
Inspiratory flow setting	The user sets the time T_{SLOPE} required to reach the set ΔP. The ventilator regulates the inspiratory flow to match the T_{SLOPE} time set by the user.
Frequency stability	If the SIMV breath is triggered, the time difference between the trigger and scheduled mandatory breath is added to the expiratory time of the next cycle.

2.10.5.1 SIMV Parameter Settings

User Adjustable Parameters for SIMV

- V_T (Tidal Volume)
- T_{INSP} (Inspiratory Time)
- Freq (Frequency)
- T_P (Inspiratory Pause)
- Trigger (Flow Trigger)
- ΔP (Differential Target Pressure)
- T_{SLOPE} (Inspiratory Slope)
- PEEP (Positive End Expiratory Pressure)

Ranges and Delivery Accuracy for SIMV

	ADULT*	**CHILD***	**DELIVERY ACCURACY**
V_T (ml)	40 - 1400 (**600**)	40 - 1400 (**120**)	Adult: ± 15% for T_{INSP} from1 - 5 ± 30% for T_{INSP} < 1 Child: ± 15%, at least 16 ml
T_{INSP} (sec)	0.2 - 5.0 (**2**)	0.2 - 5.0 (**1**)	± 10% or 0.1, whichever is greater
Freq (bpm)	2 - 60 (**4**)	2 - 60 (**4**)	± 1
T_P (%)	Off, 5 - 60 (**10**)	Off, 5 - 60 (**10**)	± 30%
Trigger (l/min)	1 - 15 (**3**)	1 - 15 (**2**)	± 1.3
ΔP (cmH_2O)	3 - 50 (**5**)	3 - 50 (**5**)	Adult: 3 - 35 (± 3 cmH_2O), 36 - 50 (± 12 cmH_2O) Child: 3 - 50 (± 3 cmH_2O)
T_{SLOPE} (sec)	0 - 2 (**0.5**)	0 - 2 (**0.5**)	± 1.0 sec
PEEP (cmH_2O)	Off, 3 - 30 (**Off**)	Off, 3 - 30 (**Off**)	3 - 12 cmH_2O (± 2 cmH_2O) 13 - 17 cmH_2O (± 3 cmH_2O) 18 - 24 cmH_2O (± 6 cmH_2O) 25 - 30 cmH_2O (± 12 cmH_2O)

* *Defaults appear in parenthesis in bold text.*

2.10.6 Pressure Support (PS)

In Pressure Support (PS) mode, the patient's effort is supported by the **AS3000** at a preset level of inspiratory pressure. Inspiration is triggered and cycled by patient effort.

The user can set the Trigger flow, Pressure Support level, PEEP, minimum allowed breathing frequency, and Slope Time. If the Freq (min) is violated, the **AS3000** will give an Apnea Ventilation breath to assure ventilation is occurring.

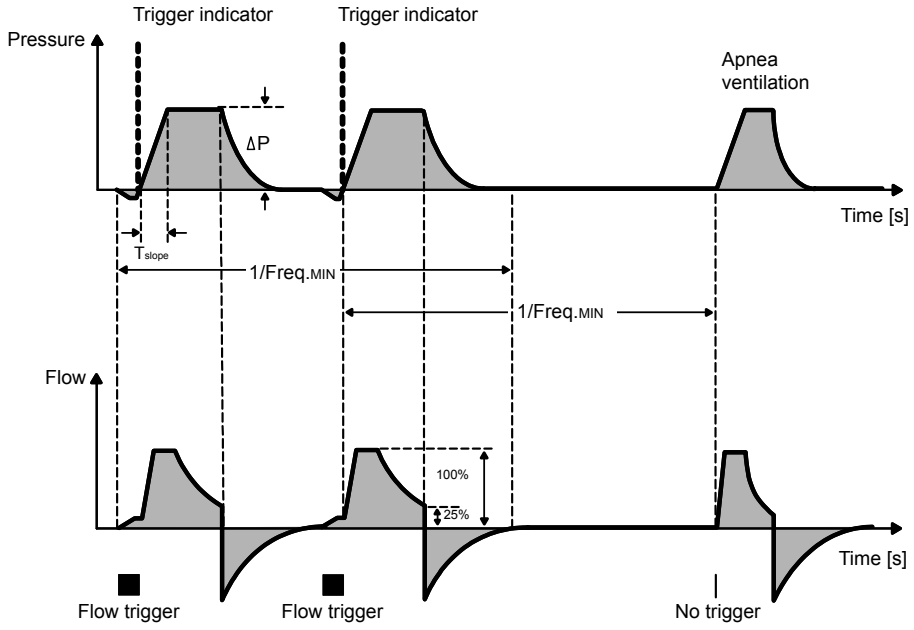


FIGURE 2-13 Typical PS Waveforms

Definitions

TRIGGER METHOD	FLOW TRIGGERED
Pressure support end	Inspiratory flow reaches 25% of the maximum value. Timeout after 3 seconds.
Ventilation end (start of breath detection phase)	Expiratory flow reaches a threshold value near 0.
Set pressure support target pressure	The set target pressure for the pressure support is a differential pressure value (ΔP).
What kind of Apnea backup should be used	The $Freq_{MIN}$ parameter in PS mode can be set by the user to avoid Apnea.
Inspiratory flow setting	The user sets the time T_{SLOPE} required to reach the set ΔP. The ventilator regulates the inspiratory flow to match the T_{SLOPE} time set by the user.

2.10.6.1 PS Parameter Settings

User Adjustable Parameters for PS

- $Freq_{MIN}$ (Frequency MIN)
- Trigger (Flow Trigger)
- ΔP (Differential Target Pressure)
- T_{SLOPE} (Inspiratory Slope)
- PEEP (Positive End Expiratory Pressure)

Ranges and Delivery Accuracy for PS

	ADULT*	**CHILD***	**DELIVERY ACCURACY**
$Freq_{MIN}$ (bpm)	2 - 60 (**2**)	2 - 60 (**4**)	± 1
Trigger (l/min)	1 - 15 (**3**)	1 - 15 (**2**)	± 1.3
Δ**P** (cmH_2O)	3 - 50 (**5**)	3 - 50 (**5**)	Adult: 3 - 35 (± 3 cmH_2O) 36 - 50 (± 12 cmH_2O) Child: 3 - 50 (± 3 cmH_2O)
T_{SLOPE} (sec)	0 - 2 (**0.5**)	0 - 2 (**0.5**)	± 1.0 sec
PEEP (cmH_2O)	Off, 3 - 30 (**Off**)	Off, 3 - 30 (**Off**)	3 - 12 cmH_2O (± 2 cmH_2O) 13 - 17 cmH_2O (± 3 cmH_2O) 18 - 24 cmH_2O (± 6 cmH_2O) 25 - 30 cmH_2O (± 12 cmH_2O)

* *Defaults appear in parenthesis in bold text.*

2.11 Parameter Monitoring

The system displays waveforms and Spirometry loops in the **Waveform Area** (item 7 in FIGURE 1-3) and digital data in the **Parameter Area** (item 8 in FIGURE 1-3). The digital data is separated into three parameter groups: Pressure, Volume, and Inspired O_2 (FiO_2).

2.11.1 Pressure

The **Pressure** parameter group consists of 3 parameters:

- Airway Peak Pressure (PEAK)
- Plateau Pressure (PLAT) or Mean Pressure (MEAN)
- Positive End Expiratory Pressure (PEEP)

The unit of measure for these parameters is **cmH_2O**. If data is over range, an up-arrow (↑) is displayed. If data is under range, a down-arrow (↓) is displayed.

NOTE: The high alarm limit for Airway Peak Pressure (PEAK) is displayed to the top right of the reading. The low alarm limit for Airway Peak Pressure (PEAK) is displayed to the bottom right of the reading.

NOTE: The display of either Plateau Pressure (PLAT) or Mean Pressure (MEAN) is configured from the System menu tab.

The associated **Pressure vs. Time** and **Flow vs. Time** waveforms are displayed together in the Waveform Area.

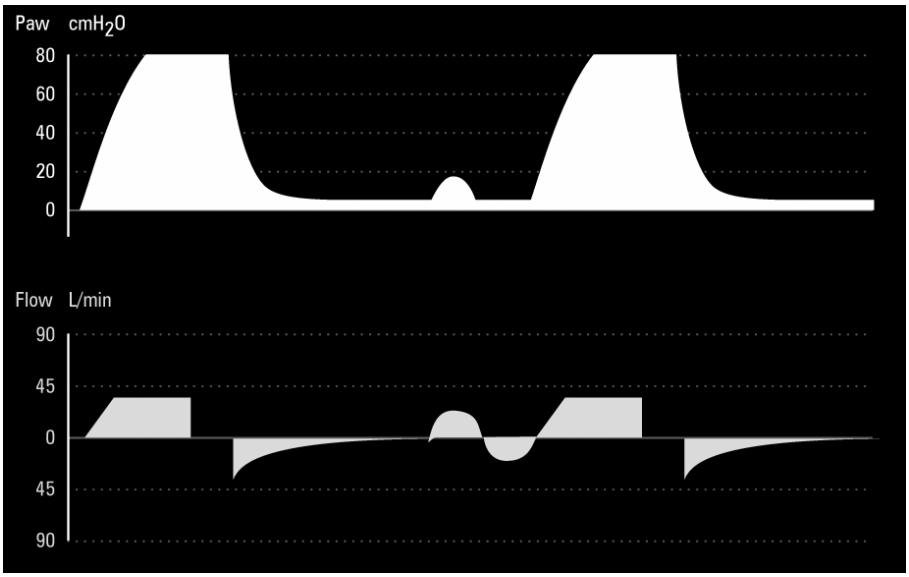


FIGURE 2-14 Example Pressure vs. Time and Flow vs. Time Waveforms

Pressure vs. Time

The Y-axis of the Pressure vs. Time waveform is labeled **Paw** (which represents **Airway Pressure**). The unit of measure is **cmH_2O** and, depending on the size of the pressure signal, the Y-axis will automatically adjust to one of the following 3 scales:

- 0 to 10, in increments of 5
- 0 to 30, in increments of 10
- 0 to 80, in increments of 20

Though the X-axis is not labeled, it represents a time scale of 0 to 15 seconds.

NOTE: Peak pressure readings that are greater than 80 cmH_2O will be clipped at 80 cmH_2O.

Flow vs. Time

The Y-axis of the Flow vs. Time waveform represents **Flow**. The unit of measure is **L/min** and its scale is -90 to +90, in increments of 45, but only absolute numbers are displayed. Though the X-axis is not labeled, it represents a time scale of 0 to 15 seconds.

2.11.2 Volume

The **Volume** parameter group consists of 3 parameters:

- Tidal Volume (V_T) - The unit of measure is **ml**.
- Minute Volume (MV) - The unit of measure is **Liter**.
- Respiration Frequency (Freq) - The unit of measure is **bpm**.

If data is over range for these parameters, an up-arrow (↑) is displayed.

NOTE: The high alarm limit for Minute Volume (MV) is displayed to the top right of the reading. The low alarm limit for Minute Volume (MV) is displayed to the bottom right of the reading.

2.11.3 Inspired O_2 (FiO_2)

- The unit of measure is **%**.
- If data is over range, an up-arrow (↑) is displayed. If data is under range, a down-arrow (↓) is displayed.

NOTE: The high alarm limit is displayed to the top right of the reading. The low alarm limit is displayed to the bottom right of the reading.

2.11.4 Spirometry

Spirometry is a respiratory monitoring technology that provides continuous (breath-by-breath) measurement of patient lung mechanics. The resultant pressure, volume, flow, compliance, and resistance data enables quick assessment of the patient's pulmonary status.

Open the **Spirometry Loop Window** by pressing the **SPIROMETRY** key.

NOTE: Pressing the NORMAL SCREEN key at any time while the Spirometry Loop Window is open will close the Spirometry Loop Window.

There are two (2) Spirometry loop display configurations that can be accessed: Pressure-Volume and Flow-Volume. By default, the Pressure-Volume loop is displayed with the first press of the **SPIROMETRY** key. The second key press displays the Flow-Volume loop. After both configurations have been cycled through the display, a third key press returns the display to the Normal Screen.

When the **Spirometry Loop Window** opens, the user may elect to store a reference loop by navigating to the **Save Reference** button, which will be highlighted. Pressing the Navigator™ Knob will then save the currently plotting loop as a reference loop (in a different color).

NOTE: Only one reference loop can be saved.

Pressure-Volume Spirometry Loop

FIGURE 2-15 is an example of the Pressure-Volume loop.

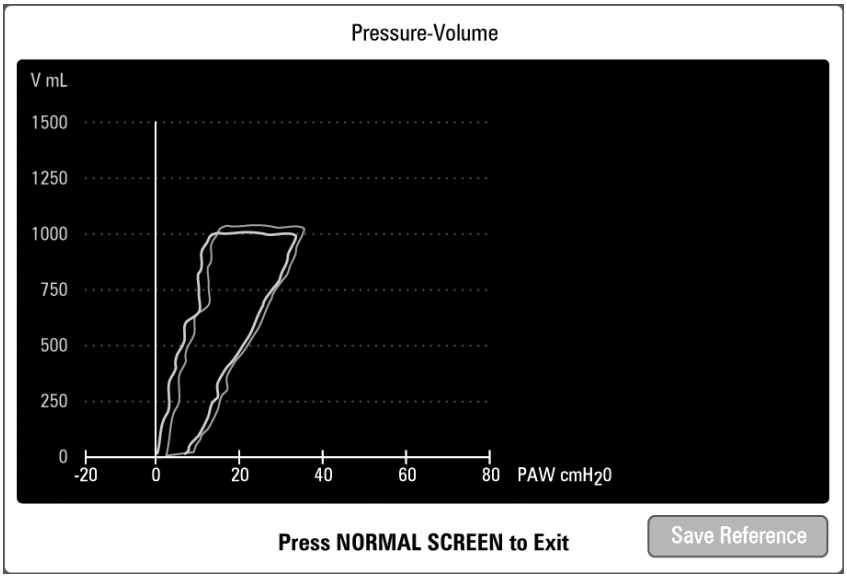


FIGURE 2-15 Example Pressure-Volume Loop

The Y-axis of the Pressure-Volume Spirometry loop represents **Volume**. The unit of measure is **ml** and its scale is 0 to 1500, in increments of 250. The X-axis is labeled **Paw** (which represents **Airway Pressure**). The unit of measure is **cmH_2O** and its scale is -20 to 80, in increments of 20.

Flow-Volume Spirometry Loop

FIGURE 2-16 is an example of the Flow-Volume loop.

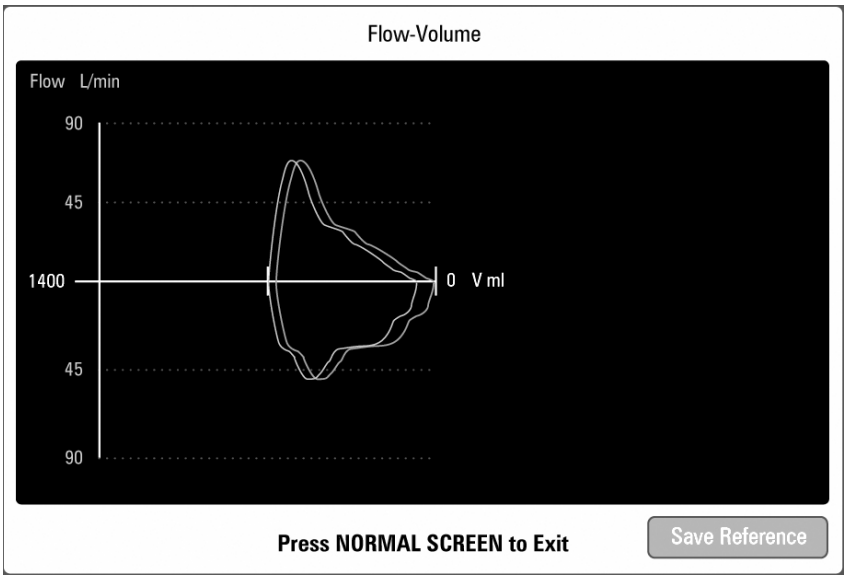


FIGURE 2-16 Example Flow-Volume Loop

The Y-axis of the Flow-Volume Spirometry loop represents **Flow**. The unit of measure is **L/min** and its scale is -90 to +90, in increments of 45, but only absolute numbers are displayed. The X-axis represents **Volume**. The unit of measure is **ml** and its scale is 0 to 1400, in increments of 750.

2.12 Alarms

Unless otherwise stated, all alarms occur immediately after the onset of an alarm event. The **Alarm** menu tab enables adjustments to alarm limits and alarm volume. To access the **Alarm** menu tab (see the example in FIGURE 2-17), press the **ALARMS LIMITS** key.

NOTE: There are separate Alarm menu tabs for the two patient types (Adult and Child) which will be indicated at the top left of each tab.

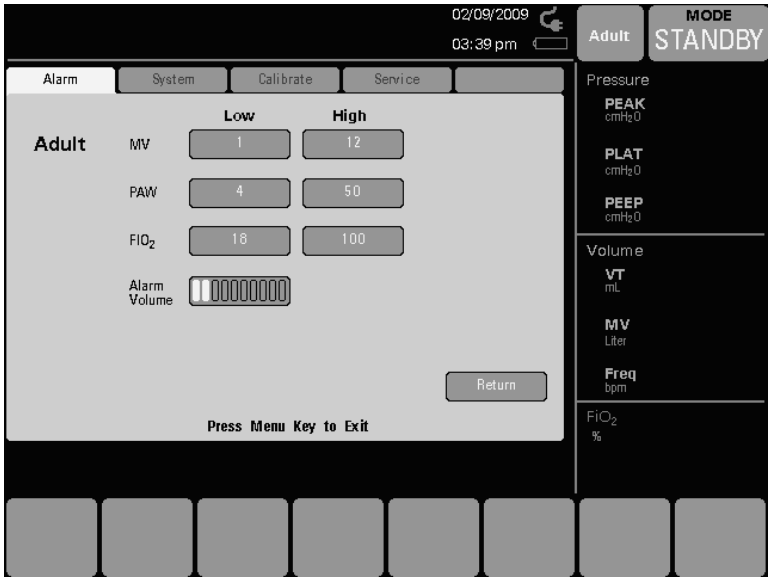


FIGURE 2-17 Example Adult Alarm menu tab

2.12.1 Setting Parameter Alarm Limits

1. From the **Alarm** menu tab, use the Navigator™ Knob to set alarm limits as desired for the parameters shown in the following table. The LOW and HIGH alarm limits for each parameter have separate defaults for the Adult and Child patient sizes.

	LOW		HIGH	
PARAMETER	**RANGE[1]**	**DEFAULT**	**RANGE[1]**	**DEFAULT**
MV (L/min)[2]	0 – 20	Adult: **1** Child: **1**	1 – 25	Adult: **12** Child: **6**
PAW (cmH_2O)[2]	0 – 70	Adult: **4** Child: **4**	10 – 80	Adult: **50** Child: **40**
FiO_2 (%)[2]	18 – 99	Adult: **18** Child: **18**	21 – 100	Adult: **100** Child: **100**

1 The increment for all ranges and all units of measure is 1.
2 Available in all ventilation modes except STANDBY.

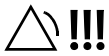
2. To save alarm limit settings, press the Navigator™ Knob.

2.12.2 Alarm Volume

The Alarm Volume sub menu is used to adjust the volume level of the audio portion of the alarms. A 10 segment bar display adjusts from 1 segment for the lowest volume to 10 segments for the highest volume. As each segment is highlighted, a sample tone for that volume level is sounded. The default volume level is 2 segments.

2.12.3 Technical Messages and Functional Alarm Messages

Based on the priority levels listed in the tables in sections 2.12.3.1 and 2.12.3.2, each message will display in the Alarm Message Area (item 2, FIGURE 1-3) with an associated symbol as follows:

- Low priority
- Medium priority
- High priority 

2.12.3.1 Technical Messages

The following table lists the individual technical messages, their associated priority levels, reasons for the messages, and possible solutions.

MESSAGE	PRIORITY	REASON(S)	SOLUTION(S)
BDU EEPROM Data Failure	N/A	Incorrect checksum during EEPROM check	This alarm occurs during startup only and renders the system non-operational. Contact technical support.
EEPROM IC Failure	N/A	EEPROM cannot read/write	This alarm occurs during startup only and renders the system non-operational. Contact technical support.
WDT Failure	N/A	Incorrect Watchdog state	This alarm occurs during startup only and renders the system non-operational. Contact technical support.
AD/DA failure	N/A	Incorrect D/A A/D data	This alarm occurs during startup only and renders the system non-operational. Contact technical support.
PEEP failure	N/A	PEEP valve data is incorrect	This alarm occurs during startup only. The leak test is bypassed and the system is placed in STANDBY ventilation mode. Contact technical support.
Inspiration Valve Failure	N/A	The valve test yielded abnormal feedback voltage.	This alarm occurs during startup only. The leak test is bypassed and the system is placed in STANDBY ventilation mode. Contact technical support.
Vent/Manual Valve Failure	N/A	Valve state incorrect	This alarm occurs during startup only and renders the system non-operational. Contact technical support.
Expiration Sensor Failure	N/A	The expiration sensor data is incorrect.	This alarm occurs during startup only and renders the system non-operational. Contact technical support.

MESSAGE	PRIORITY	REASON(S)	SOLUTION(S)
O_2 Supply Failure	High	O_2 gas pressure is lower than 29.1 psi ± 15% for more than 0.5 seconds.	If this alarm occurs during startup, the leak test is bypassed and the system is placed in STANDBY ventilation mode. Contact technical support. Check the O_2 supply line and the O_2 cylinder. Replace the O_2 cylinder if necessary.
Power Fail	Low	The main AC power has failed. **NOTE:** The system automatically switches to battery power to provide approximately 45 minutes of run time.	Ensure that the AC power cord is connected to the receptacle. Check the main power supply and fuses. Replace fuses as necessary. Contact technical support if the problem is not resolved.
Low Battery	Medium	During battery operation, the battery voltage decreases below 22 Volts. **NOTE:** When this alarm occurs, there are only 10 minutes remaining until the system shuts down.	Resume AC power operation immediately. Manually ventilate the patient. Ensure that the battery remains fully charged at all times.
O_2 Sensor Failure (This alarm can occur during startup or normal operation.)	High	The O_2 sensor cable is disconnected or the O_2 sensor has failed.	Ensure that the O_2 sensor is properly connected at both ends. Replace the O_2 sensor if it has failed. If this alarm occurs during startup, the system is rendered non-operational. Repeat the startup tests as necessary. Contact technical support.
BDU Communication Failure (This alarm can occur during startup or normal operation.)	High	If this alarm occurs during normal operation, the GUI cannot send or receive data from the BDU unit for more than 0.5 seconds.	If this alarm occurs during startup, the system is rendered non-operational. Contact technical support. If this alarm occurs during normal operation, manually ventilate the patient.
Alarm Speaker Failure	N/A	During startup testing, no response was received from the alarm speaker.	This alarm occurs during startup only and places the system in STANDBY ventilation mode. All system functions except audible alarms are available. Contact technical support.

MESSAGE	PRIORITY	REASON(S)	SOLUTION(S)
O_2 Cal Due	Low	72 hours have elapsed since the last O_2 Calibration.	
Software Version Error	N/A	When the internal BDU, user interface, and keyboard software components were checked for proper configuration, the software versions did not match with the released set.	This alarm occurs during startup only and renders the system non-operational. Contact technical support.
Keyboard Communication Failure (This alarm can occur during startup or normal operation.)	Low	Internal electrical failure of subsystems communication	If this alarm occurs during startup, the system is rendered non-operational. If this alarm occurs during normal operation, the ventilator will continue to operate in the current mode with the current settings and the user interface display will be shut down after one (1) minute. The system should be considered non-functional at the time of this alarm. Contact technical support.
Pressure Sensor Failure	N/A	The startup test of the PAW sensor yielded an abnormal voltage at ambient pressure.	This alarm occurs during startup only and renders the system non-operational. Contact technical support.
Inspiration Sensor Fail	N/A	The inspiration sensor data is incorrect. Fresh gas is flowing during startup.	This alarm occurs during startup only and places the system in STANDBY ventilation mode.Try re-starting the system with all gas flows OFF. If message reappears, switch to MANUAL ventilation mode and manually ventilate patient. Contact technical support.
Software Mismatch or Failure to Shut Down Completely	N/A	Power is recycled to the unit too quickly.	Applicable to UI versions 2.25 and higher. This alarm occurs during startup only. Shut down the unit and wait until the backlight is fully extinguished before restoring power.

2.12.3.2 Functional Alarm Messages

The following table lists the individual functional alarm messages, their associated priority levels, reasons for the messages, and possible solutions.

MESSAGE	PRIORITY	REASON(S)	SOLUTION(S)
Continuous Pressure	High	Pressure sensor failure, sampling channel blockage, excessive exhalation resistance (possibly due to channel blockage)	Switch to bag mode and manually ventilate patient, check tubes and sampling lines, fix any blockages. If the alarm still exists, contact technical support.
High Airway Pressure*	High	V_T is set too high, patient airway blockage, exhalation valve blockage	Reset the High PAW alarm limit, check expiratory cycle, fix any blockages. Check V_T settings. Check patient airway, fix any blockages.
Low Airway Pressure*	Medium	For Freq setting >= 4: Airway pressure below pressure alarm low limit for > 15 seconds For Freq setting < 4: Airway pressure below pressure alarm low limit for > 30 seconds	Reset the Low PAW alarm limit. Check the parallel sampling lines.
Negative Pressure	High	Airway Pressure of -2 cmH_2O or less for more than 4 seconds.	Check patient or increase supply of fresh gas.
Low FiO_2	High	The FiO_2 reading is less than the low alarm limit setting, compensation of air or N_2O is too high, un-calibrated O_2 sensor, O_2 sensor failure	Reset the Low FIO_2 alarm limit. Reduce compensation. Perform the calibration. Replace O_2 sensor.
High FiO_2	Medium	The FiO_2 reading is greater than the high alarm limit setting.	Reset the High FIO_2 alarm limit.
High Minute Volume*	Medium	The MV reading is greater than the high alarm limit setting.	Reset the High MV alarm limit.
Low Minute Volume*	Medium	The MV reading is less than the low alarm limit setting, leakage of the patient breathing circuit occurs	Reset the Low MV alarm limit. Check for leakage at patient connections.

* *These functional alarm messages are disabled when Manual Mode Alarm control on the Main Screen is set to "OFF" and the ventilation mode is set to MANUAL.*

MESSAGE	PRIORITY	REASON(S)	SOLUTION(S)
APNEA*	High	Breathing/ventilation has stopped (detected by pressure and volume monitoring) for a period greater than 30 seconds in mechanical ventilation modes or for greater than 60 seconds in manual ventilation mode.	Check patient
APNEA Backup	Medium	$Freq_{MIN}$ in PS mode triggers the ventilator.	Check patient
High PEEP	Medium	Expiratory pressure 5 cmH_2O above PEEP for 2 breaths, or Expiratory pressure 5 cmH_2O above PEEP in PS mode for more than 30 seconds	Check waste gas hose for moisture

* *These functional alarm messages are disabled when Manual Mode Alarm control on the Main Screen is set to "OFF" and the ventilation mode is set to MANUAL.*

2.12.4 Alarm Functions Test

1. Activate the **CMV** ventilation mode.

2. Set attributes as follows:

ATTRIBUTE	SETTING
Patient Size	Adult
V_T	600
Breath Rate	8
I:E	1:2
PEEP	Off
T_P	10
O_2 Flow	2 Liters/minute

3. Perform steps 20 to 23 of the Preoperative Checkout in section 2.4.

2.13 System

The **System** menu tab contains configuration settings for Pressure Display, Language, Display mode, Date and Time, and System Defaults. This menu also includes the result of the last leak test performed.

FIGURE 2-18 Example System menu tab

1. Pressure Display

Provides selections of **Pplat** (Plateau Pressure) or **Pmean** pressure display. The default is **Pplat**.

2. Language

Allows the user to choose from available display languages.

NOTE: The AS3000 is only available in English.

3. Display

Accesses the **AS3000**'s demo mode.

NOTE: This Feature is password protected and is intended for use by Mindray personnel only.

4. Date

Provides for adjustment of the current date and selections for date format.

5. Time

Provides for adjustment of the current time and selections for time format.

6. Restore Defaults

Allows the user to restore alarm limits, pressure display and ventilation settings to default values.

7. Leak Test

Allows the user to show the result of the latest Leak Test. To show the Leak Test result, select **Show Result** from the Leak Test menu. The Leak Test Result will be displayed on the right portion of the System menu tab (see figure 2-19).

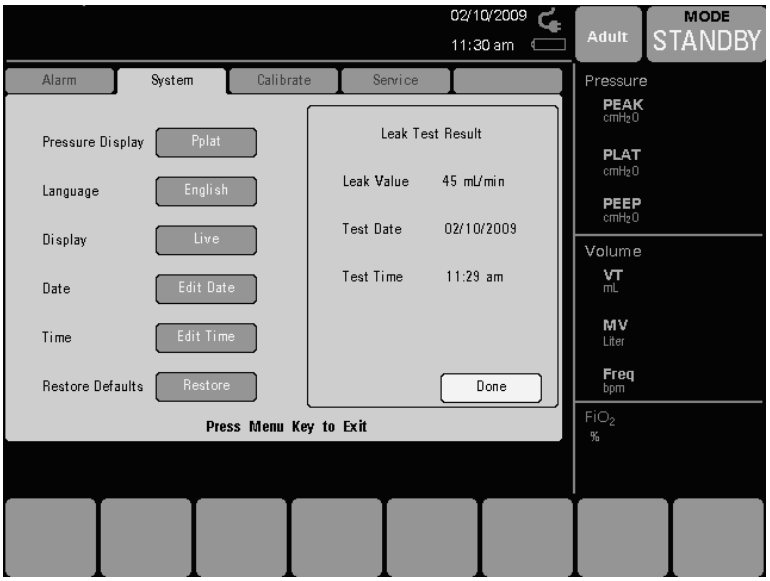


FIGURE 2-19 Example Leak Test Results

The Leak Test Result screen displays **Leak Value,** displayed in mL/min, The **Test Date**, the date the test was performed and **Test Time** the time the test was performed. If the Leak Test was bypassed, a value of **Bypassed** will be displayed for **Leak Value** (see figure 2-20).

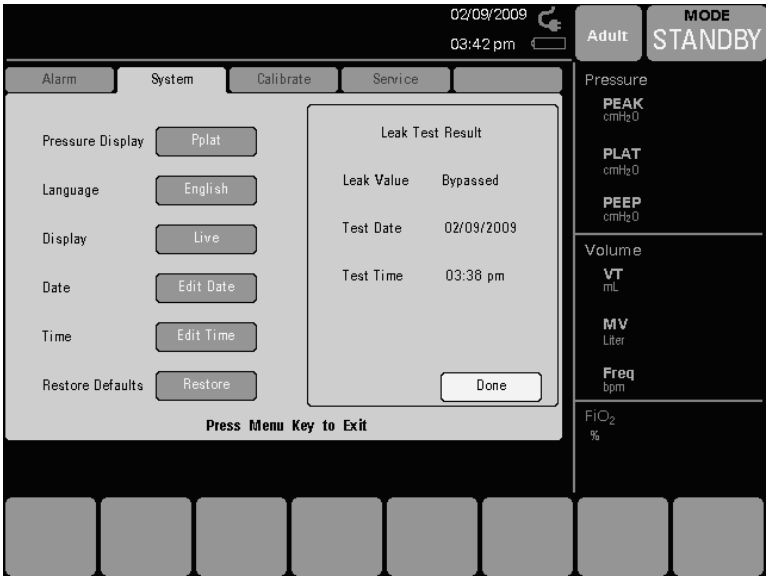


FIGURE 2-20 Example of a Bypassed Leak Test

3.0 User Maintenance

WARNING: Use a cleaning and disinfection schedule that conforms to your institution's disinfection and risk-management policies.

- **Refer to the material safety data as applicable.**
- **Refer to the operation and maintenance manuals of all disinfection equipment.**
- **Do not inhale fumes that may result from any disinfection process.**

WARNING: Do not use talc, zinc stearate, calcium carbonate, corn starch or similar material to prevent sticking of the bellows, as these materials may enter the patient's lungs or airway, causing irritation or injury.

CAUTION: To prevent system damage:

- **Refer to the literature supplied by the manufacturer of the cleaning agent.**
- **Never use organic, halogenated or petroleum-based solvents, anesthetics, glass cleaning agents, acetone or other irritant agents.**
- **Never use abrasive agents (i.e. steel wool or silver polish) to clean components.**
- **Keep all liquids away from electronic components.**
- **Prevent liquid from entering the equipment.**
- **All cleaning solutions used must have a pH between 7.0 and 10.5.**

CAUTION: Never immerse the oxygen sensor or its connector in any type of liquid.

- **Dispose of the oxygen sensor per the manufacturer's specification.**

CAUTION: Do not wash the inner surface of the oxygen sensor.

CAUTION: Prior to use after cleaning or disinfecting, power up the system as described in section 2.6 and follow the on-screen prompts to perform the Leak Test and the Compliance Test.

CAUTION: The PAW gauge and oxygen sensor cannot withstand immersion or the heat and pressure of autoclaving.

CAUTION: Do not autoclave the airway pressure limiting (APL) valve.

3.1 Cleaning and Disinfection

CAUTION: Prior to use after cleaning or disinfecting, power up the system as described in section 2.6 and follow the on-screen prompts to perform the Leak Test and the Compliance Test.

3.1.1 General Guidelines

Heed all WARNINGS and CAUTIONS listed at the beginning of this chapter. Prior to use, refer to the facility's infection control policy to determine the frequency and level at which cleaning and disinfection should be performed. If disinfection is required, all components must first be cleaned and dried as described in the following sub-sections. For additional information about infection control practices, refer to the *APIC Guidelines for Selection and Use of Disinfectants*, published in the American Journal of Infection Control, Vol. 24, No. 4, August 1996.

For additional information about infection control, refer to the ASA's Recommendations for Infection Control for the Practice of Anesthesiology, second edition. For additional information on reprocessing medical devices, refer to AAMI TIR 30:2003, A compendium of process, materials, test methods, and acceptance criteria for cleaning reusable medical devices.

3.1.2 External Surfaces

- Using a soft cloth with a water-soluble detergent or disinfectant wipes, clean all outer surfaces, hoses, and cables. If using disinfectant wipes, follow the manufacturer's instructions for use.

3.1.3 Bellows Assembly

FIGURE 3-1 Bellows Assembly

Read all content in this section before disassembling, cleaning, disinfecting, and re-assembling the bellows to avoid equipment malfunction and patient injury.

1. The bellows dome is a transparent cover with graduation marks from 300 to 1500. Remove the bellows dome by turning it counterclockwise and lifting it away from the breathing system. See FIGURE 3-2.

FIGURE 3-2 Removing the Bellows Dome

2. Detach the bellows from the base plate as shown in FIGURE 3-3.

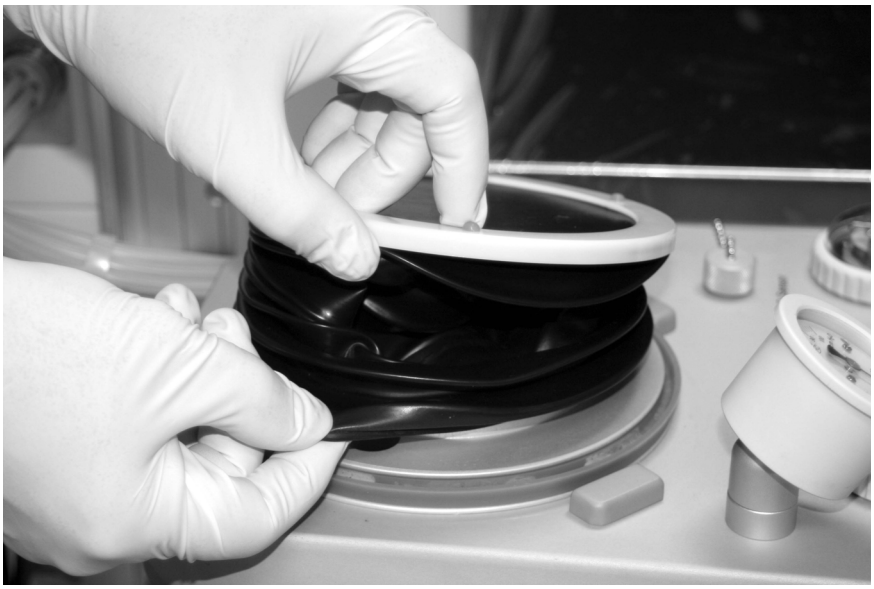


FIGURE 3-3 Detaching the Bellows

3. Detach the top plate from the bellows as shown in FIGURE 3-4.

FIGURE 3-4 Detaching the Top Plate

NOTE: **While performing the following step, note the orientation of the bellows adapter ring as it is being removed to ensure that it is properly inserted during reassembly.**

4. Remove the bellows adapter ring from inside the bellows as shown in FIGURE 3-5.

FIGURE 3-5 Removing the Bellows Adapter Ring

5. Remove the bellows dome O-ring as shown in FIGURE 3-6.

FIGURE 3-6 Removing the Bellows Dome O-ring

6. Cleaning

a. To prevent damage, wash each component gently with hot water, using a mild, non-enzyme detergent that is recommended for rubber and plastic. Ensure that all bellows surfaces are cleaned.

b. Rinse with clean, hot water, and allow to dry.

NOTE: **Dry the bellows by allowing it to hang so that it is fully expanded. This will facilitate thorough drying and prevent it from sticking to itself.**

CAUTION: **If moisture remains in the bellows after cleaning, it may become tacky.**

c. After all bellows components are completely dry, inspect them for damage before disinfection or re-assembly and functional testing.

d. If disinfecting the bellows components, continue with step 7, otherwise skip to step 8.

7. Disinfection

NOTE: Ensure that all bellows components have been cleaned as described in step 6 before disinfecting.

Using an FDA cleared Gluteraldehyde disinfection solution, follow the manufacturer's instructions for high level disinfection and rinsing of all bellows components while adhering to facility policies and procedures.

8. Connect the bellows to the breathing system by reassembling all components in the reverse order. Prior to use after cleaning or disinfecting, power up the system as described in section 2.6 and follow the on-screen prompts to perform the Leak Test and the Compliance Test.

3.1.4 Inspiration and Expiration Valves

The following procedure is written generically for a single, unspecified valve. It should be performed on both the inspiration and expiration valves.

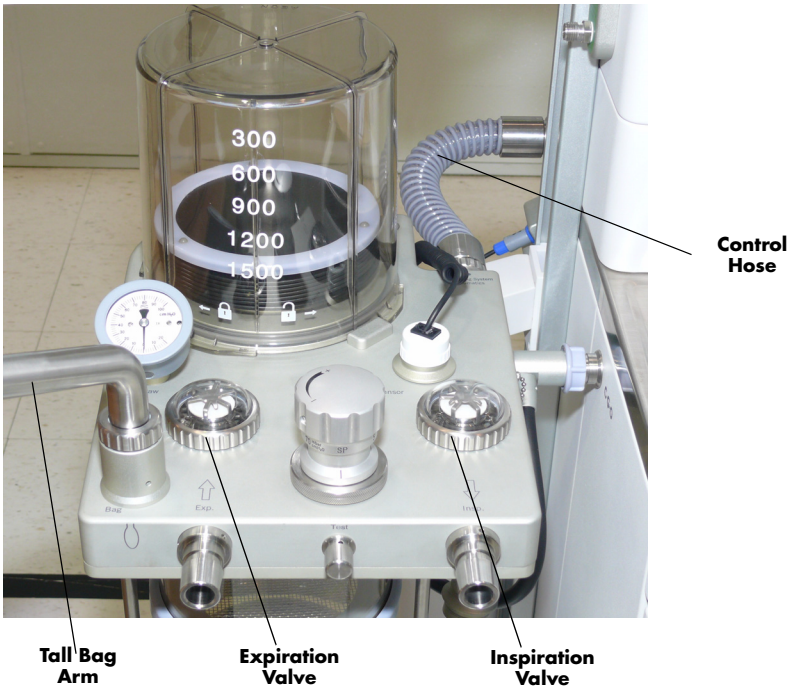


FIGURE 3-7 Location of Expiration and Inspiration Valves

1. Turning it counterclockwise, loosen and remove the valve retaining ring as shown in FIGURE 3-8.

FIGURE 3-8 Valve Retaining Ring Removal

2. Remove the valve dome as shown in FIGURE 3-9, ensuring that the valve o-ring (also shown) remains seated.

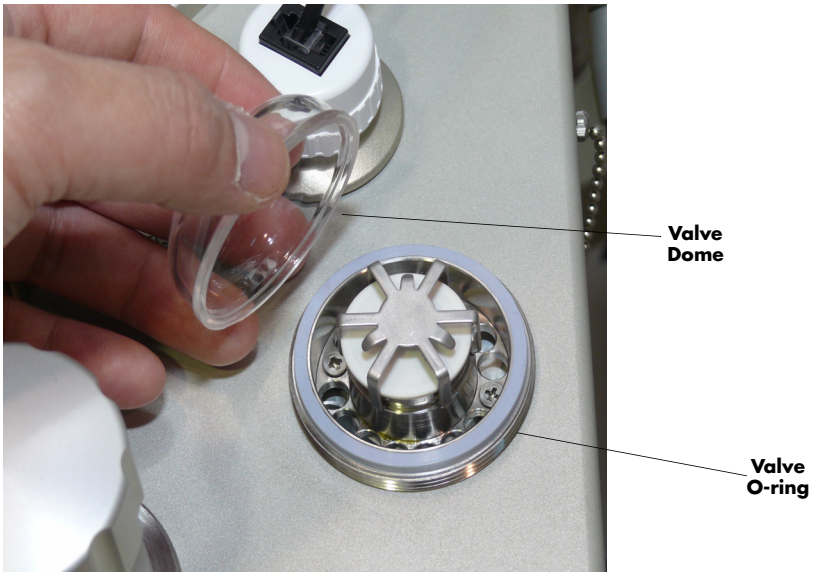


FIGURE 3-9 Valve Dome Removal

CAUTION: The valve disc is fragile and must, therefore, be handled with care while removing the valve cage from the valve assembly.

3. The valve cage will be removed in this step (refer to FIGURE 3-10). The six prongs of the valve cage have tabs that secure it in the valve assembly. While noting the previous **CAUTION**, use two hands to remove the valve cage by gently manipulating the prongs to release the tabs. As the valve cage is lifted away from the assembly, ensure that the valve disc does not fall out.

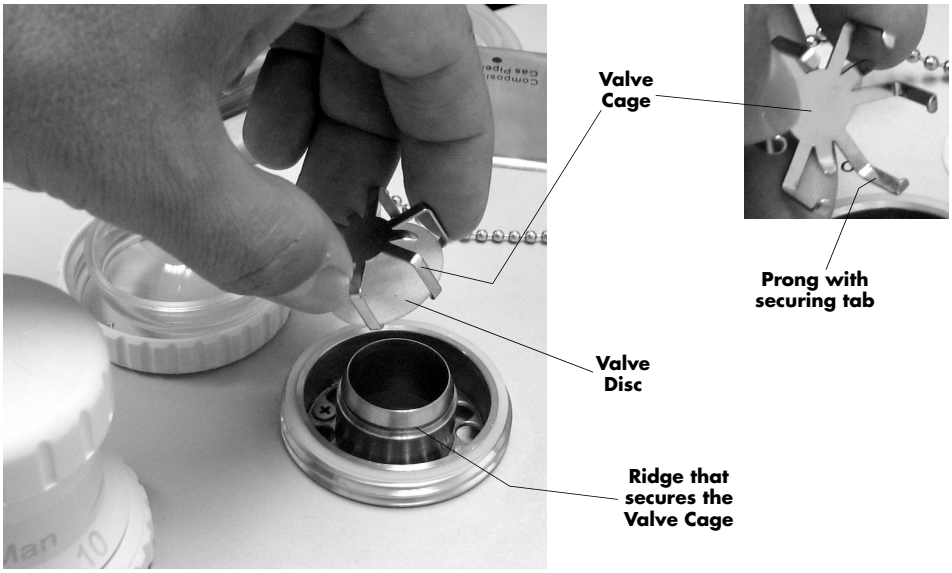


FIGURE 3-10 Valve Cage Removal

CAUTION: The valve disc is fragile and must, therefore, be handled with care while removing it from the valve cage.

4. Remove the valve disc from the valve cage as shown in FIGURE 3-11.

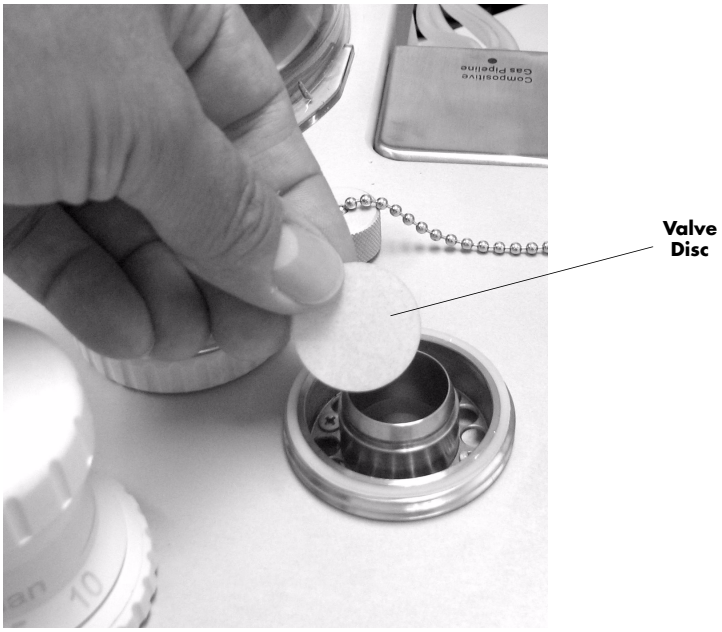


FIGURE 3-11 Valve Disc Removal

5. Cleaning

a. Wash each component using a mild detergent and water solution.

b. Rinse with clean, hot water, and allow to dry.

c. After all components are completely dry, verify that the valve disc and the prongs of the valve cage are undamaged before disinfection or re-assembly and functional testing.

d. If disinfecting the valve components, continue with step 6, otherwise skip to step 7.

6. Disinfection

NOTE: Ensure that all valve components have been cleaned as described in step 5 before disinfecting.

Using an FDA cleared Gluteraldehyde disinfection solution, follow the manufacturer's instructions for high level disinfection and rinsing of all valve components while adhering to facility policies and procedures.

7. Reassemble the valve components in the reverse order, noting any previously stated **CAUTION**. Prior to use after cleaning or disinfecting, power up the system as described in section 2.6 and follow the on-screen prompts to perform the Leak Test and the Compliance Test.

3.1.5 Oxygen Sensor

1. The oxygen sensor is a component that is pressed into position for use. It is not necessary to remove this component to clean it. However, if removal is desired, first disconnect the oxygen sensor external cable as shown in FIGURE 3-12. Then grasp the oxygen sensor and lift it away from the absorber block as shown in FIGURE 3-13.

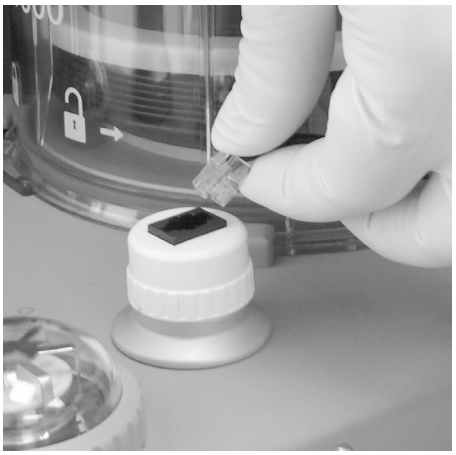


FIGURE 3-12 Oxygen Sensor External Cable Removal

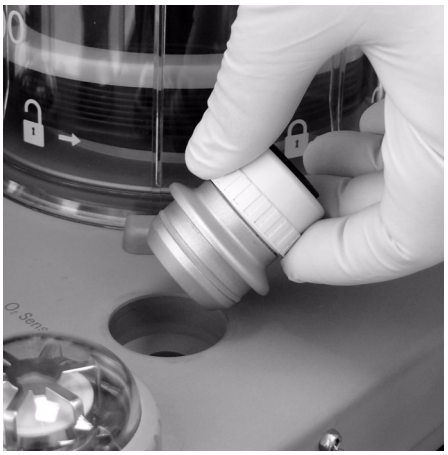


FIGURE 3-13 Oxygen Sensor Removal

CAUTION: Never immerse the oxygen sensor or its connector in any type of liquid.

- **Dispose of the oxygen sensor per the manufacturer's specification.**

CAUTION: Do not wash the inner surface of the oxygen sensor.

CAUTION: Do not autoclave the oxygen sensor.

2. Clean the oxygen sensor exterior with a soft, lint-free cloth, and a mild detergent and water solution. Allow to dry thoroughly.

3. Inspect the oxygen sensor for damage and replace as necessary.

4. Re-insert the oxygen sensor if it had been removed.

3.1.6 APL Valve

1. Loosen the APL valve at its base by turning it counterclockwise, and then remove the APL valve as shown in FIGURE 3-14.

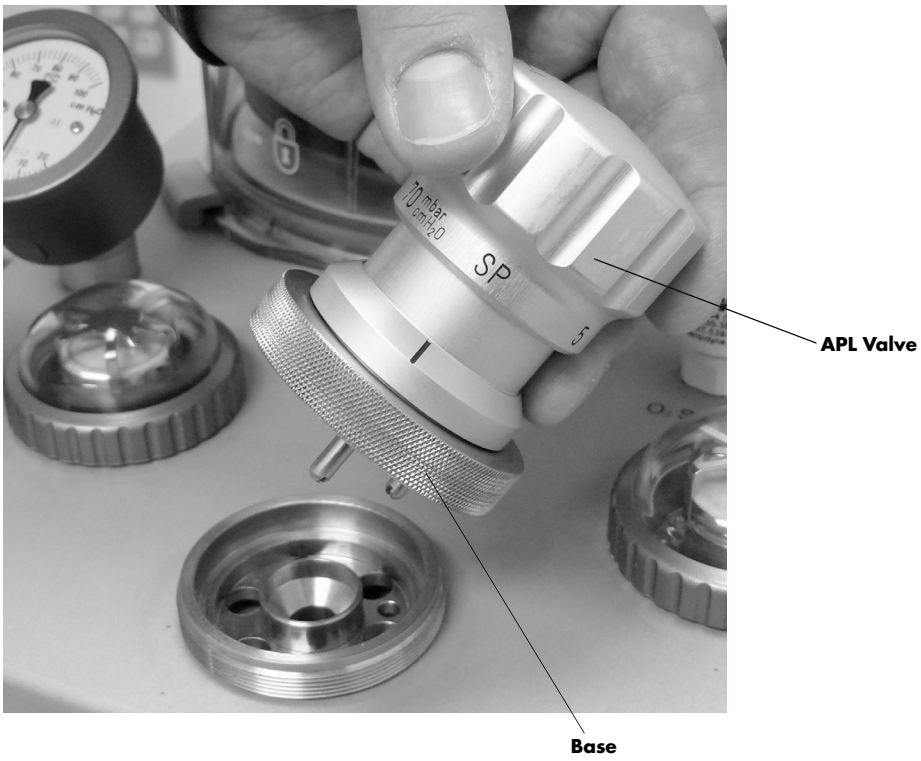


FIGURE 3-14 APL Valve Removal

2. Cleaning

a. Clean the APL valve with a soft, lint-free cloth, and a solution of mild detergent and water. Allow it to dry thoroughly.

b. If disinfecting the APL valve, continue with step 3, otherwise skip to step 4.

3. Disinfection

NOTE: Ensure that the APL valve has been cleaned as described in step 2 before disinfecting.

Using an FDA cleared Gluteraldehyde disinfection solution, follow the manufacturer's instructions for high level disinfection and rinsing of the APL valve while adhering to facility policies and procedures.

4. Replace the APL valve by turning its base clockwise until it is securely tightened. Prior to use after cleaning or disinfecting, power up the system as described in section 2.6 and follow the on-screen prompts to perform the Leak Test and the Compliance Test.

3.1.7 PAW Gauge

1. The PAW gauge is a component that is pressed into position for use. It is not necessary to remove this component to clean it. However, if removal is desired, simply grasp it and lift it away from the absorber block as shown in FIGURE 3-15.

FIGURE 3-15 PAW Gauge Removal

CAUTION: The PAW gauge and oxygen sensor cannot withstand immersion or the heat and pressure of autoclaving.

2. Clean the PAW gauge with a soft, lint-free cloth, and a mild detergent and water solution. Allow it to dry thoroughly.

3. Re-insert the PAW gauge if it was removed. Prior to use after cleaning or disinfecting, power up the system as described in section 2.6 and follow the on-screen prompts to perform the Leak Test and the Compliance Test.

3.1.8 Bag Arm

1. Turning it counterclockwise, loosen the bag arm retaining ring and then remove the bag arm from the breathing system block (see FIGURE 3-16).

FIGURE 3-16 Bag Arm Removal

2. Cleaning

a. Clean the bag arm with a soft, lint-free cloth, and a solution of mild detergent and water. Allow it to dry thoroughly.

b. If disinfecting the bag arm, continue with step 3, otherwise skip to step 4.

3. Disinfection

NOTE: Ensure that the bag arm has been cleaned as described in step 2 before disinfecting.

Using an FDA cleared Gluteraldehyde disinfection solution, follow the manufacturer's instructions for high level disinfection and rinsing of the bag arm while adhering to facility policies and procedures.

4. Reassemble the bag arm to the breathing system. Prior to use after cleaning or disinfecting, power up the system as described in section 2.6 and follow the on-screen prompts to perform the Leak Test and the Compliance Test.

3.1.9 Absorber Canisters

WARNING: Do not remove the absorber canister while the ventilator is running in an automatic ventilation mode. This should only be done in STANDBY mode with no patient connected.

1. Locate the absorber drain as shown in FIGURE 3-17.

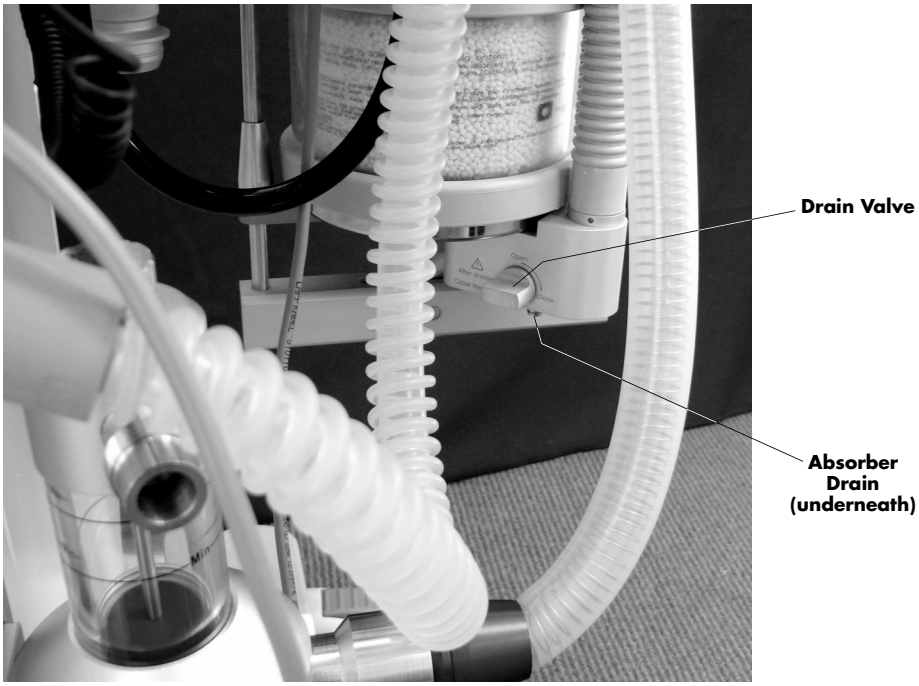


FIGURE 3-17 Absorber Drain Valve Location

2. Refer to FIGURE 3-18. While holding a small cup below the drain, turn the valve to the **Open** position and collect any water that may have gathered. Turn the valve to the **Close** position and discard the water.

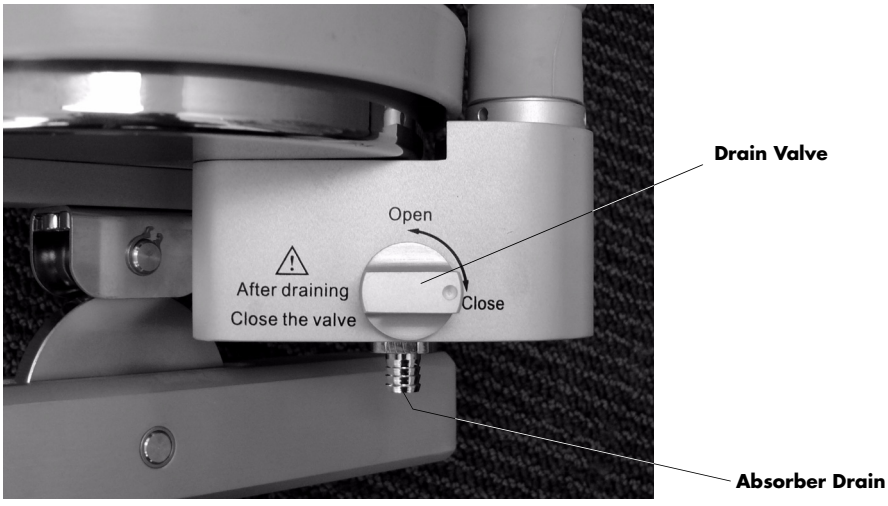


FIGURE 3-18 Absorber Drain Valve (Close Up View)

WARNING: Use extreme care while handling the absorbent as it is a caustic irritant.

3. Rotate the locking mechanism handle counterclockwise into the unlocked position as shown in FIGURE 3-19. This separates the absorber canisters from the top of the assembly. While noting the previous **WARNING**, remove the absorber canisters. Then remove the pre-pak or loose fill absorbent from the canisters. Dispose of the absorbent per the manufacturer's specification.

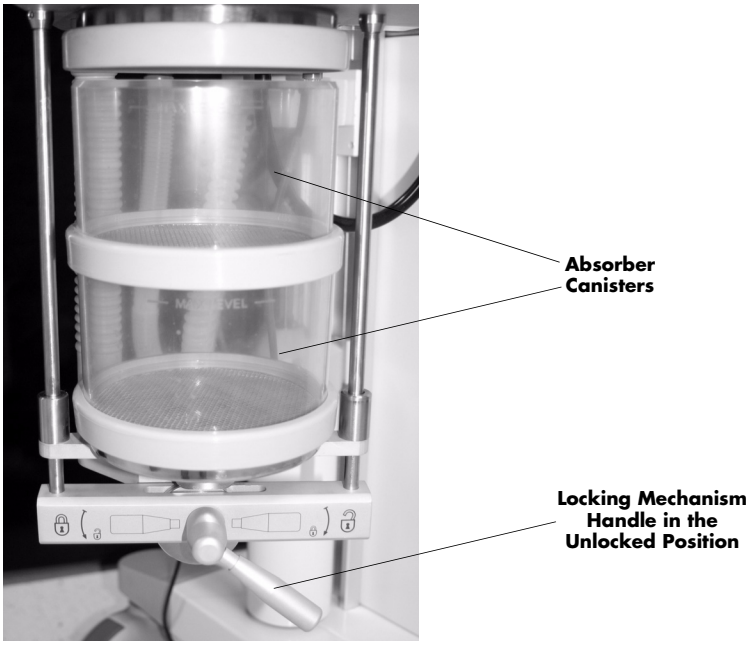


FIGURE 3-19 Absorber Canisters, Unlocked

4. Cleaning

a. Clean the absorber canisters with a soft, lint-free cloth, and a solution of mild detergent and water. Allow them to dry thoroughly.

b. If disinfecting the Absorber Canisters, continue with step 5, otherwise skip to step 6.

5. Disinfection

NOTE: Ensure that the Absorber Canisters have been cleaned as described in step 4 before disinfecting.

Using an FDA cleared Gluteraldehyde disinfection solution, follow the manufacturer's instructions for high level disinfection and rinsing of the Absorber Canisters while adhering to facility policies and procedures.

WARNING: Use extreme care while handling the absorbent as it is a caustic irritant.

NOTE: Ensure that the absorber canisters are completely dry before adding absorbent.

6. While noting the previous **WARNING**, add new pre-pak or loose fill absorbent to the absorber canisters. Re-install the absorber canisters into the assembly. Rotate the locking mechanism handle clockwise into the locked position as shown in FIGURE 3-20.

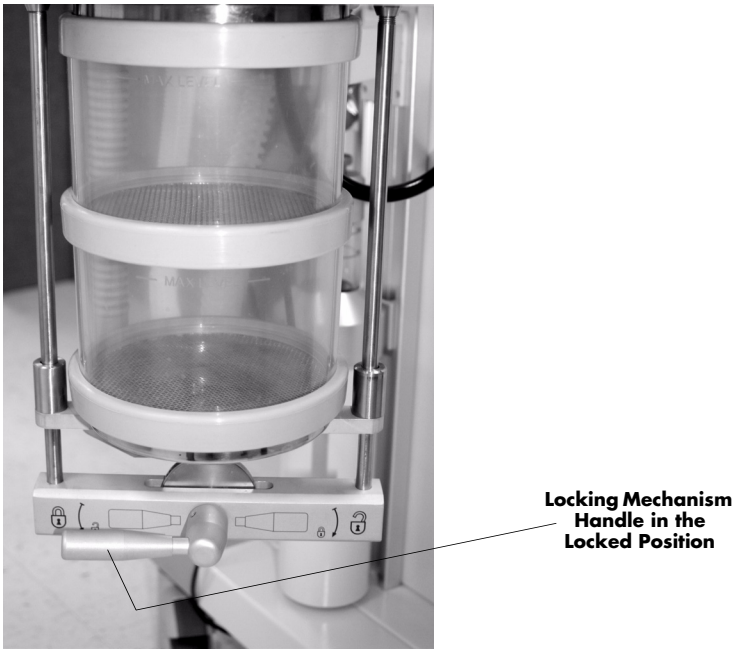


FIGURE 3-20 Absorber Canisters, Locked

3.1.10 Breathing System Block

1. Remove all of the following components from the breathing system block:

- Bellows Assembly
- Oxygen Sensor
- Inspiratory and Expiratory Valves (all components)
- APL Valve
- PAW Gauge
- Bag Arm
- Absorber Canisters

2. Disconnect the fresh gas hose from the CGO (Common Gas Outlet) on the left side of the system. The opposite end of this hose is integrated into the breathing system block and therefore, does not get removed.

3. Disconnect the waste gas hose, drive gas hose, and heater cable from the bottom of the breathing system block.

4. Disconnect the breathing system pneumatic hoses from the side of the breathing system block.

NOTE: At this point, the breathing system block is ready to be removed from its mounting arm.

WARNING: Use care in lifting and manipulating the breathing system block during removal from its mounting arm as handling may be awkward due to its weight and shape.

5. While grasping the sides of the breathing system block as shown in FIGURE 3-21, lift it away from its mounting arm.

FIGURE 3-21 Breathing System Block Removal

6. Cleaning

a. Clean the breathing system block exterior with a soft, lint-free cloth, and a mild detergent and water solution. Allow to dry thoroughly.

b. If disinfecting the breathing system block, continue with step 7, otherwise skip to step 8.

7. Disinfection

NOTE: Ensure that the breathing system block has been cleaned as described in step 6 before disinfecting. High level disinfection of the breathing system block can be performed through steam autoclaving up to a maximum temperature of 134 °C (273 °F).

Using an autoclave, follow the manufacturer's instructions for high level disinfection of the breathing system block while adhering to facility policies and procedures.

8. Reassemble the breathing system components in reverse order. Prior to use after cleaning or disinfecting, power up the system as described in section 2.6 and follow the on-screen prompts to perform the Leak Test and the Compliance Test.

3.1.11 AGSS (Anesthetic Gas Scavenging System) and AGSS Transfer Hose

1. Disconnect the EVAC hose from the AGSS.
2. Remove the AGSS and Transfer Hose from the **AS3000** as shown in FIGURE 3-22.

FIGURE 3-22 AGSS and Transfer Hose Removal

3. Clean the outer surface of the AGSS and Transfer Hose with a soft, lint-free cloth, and a mild detergent and water solution. Allow to dry thoroughly.

4. Remove the top of the AGSS as shown in FIGURE 3-23. Inspect the AGSS filter as shown in FIGURE 3-24 and shake it over a waste container to clean it as necessary. If the filter must be replaced, dispose of the old filter per local government policy.

FIGURE 3-23 Removal of AGSS Top

FIGURE 3-24 AGSS Filter Inspection

5. Reassemble the AGSS and Transfer Hose and reconnect them to the **AS3000** in the reverse order.

3.2 Regular Maintenance

WARNING: To avoid endangering a patient, do not perform testing or maintenance when the machine is in use.

Visual inspection should be performed every 30 days to ensure timely replacement of worn or damaged parts.

1. Power off the system.
2. Perform an overall visual inspection of the system.
3. Power up the system as described in section 2.6 and follow the on-screen prompts to perform the Leak Test and the Compliance Test.

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4.0 Accessories

The following accessories are designed for the **AS3000** Anesthesia Delivery System. The use of other accessories is not recommended. To place an order for these or other accessories, contact Customer Service at 1.800.288.2121 or order accessories online at www.mindray.com.

4.1 Vaporizers

- Vaporizer, Sevoflurane (P/N 0992-00-0148)
- Quickfill Bottle Adapter, Sevoflurane (P/N 0004-00-0100)
- Vaporizer, Isoflurane (P/N 0992-00-0149)
- Quickfill Bottle Adapter, Isoflurane (P/N 0004-00-0101)

4.2 Gas Supply Hoses

10 Foot Length

GAS	P/N[2]	OHMEDA[3]	CHEMETRON[3]	PURITAN BENNETT[3]	DISS FEMALE[3]
O_2	0004-00-0077-XX	-01	-02	-03	-04
N_2O	0004-00-0078-XX	-01	-02	-03	-04
Air	0004-00-0079-XX	-01	-02	-03	-04
VAC	0004-00-0080-XX	-03	-04	-05	-06
EVAC	0004-00-0081-XX	-01	-02	-03	-04
EVAC[1]	0004-00-0081-XX	-21	-22	-23	-24

1 VAC wall connector

2 The "-XX" in each P/N (Part Number) represents a "Tail Code" that completes the P/N. See footnote 3.

3 -XX Tail Codes (substitute these numbers for the -XX in the P/N column to complete the Part Number)

4.3 CO_2 Absorbers

- CO_2 Absorber Pre-Pack (P/N 0683-00-0326-01)
- Loose Fill CO_2 Absorber (P/N 0683-00-0325-01)

4.4 Miscellaneous

- DPM 6/7 to AS3000 Installation Kit (P/N 0040-00-0452)
- DPM 6/7 Module Rack Mounting Kit (P/N 0040-00-0451)
- Monitor Mounting Arm, Pivoting, 16" (P/N 0436-00-0198)
- Suction Regulator (P/N 0992-00-0256)
- Suction Regulator Mount (P/N 0436-00-0207)
- Suction Canister Bracket (P/N 0436-00-0212)
- Bag, Reservoir, Reusable (P/N 0138-00-0022)
- Adult Test Lung (P/N 0138-00-0012)
- Utility Tray (P/N 0436-00-0204)
- Writing Surface Insert (P/N 045-000250-00) for Utility Tray (P/N 0436-00-0258)
- AS3000 User Maintenance Kit (P/N 0040-00-0457)

5.0 *Product Specifications*

5.1 Safety Designations

Safety designations per IEC 60601-1 Standard:

Type of protection against electric shock:	Class 1 and Internal Electric Power Source. Where the integrity of the external protective earth conductor arrangement is in doubt, equipment shall be operated from its internal electric power source.
Degree of protection against electric shock:	Type BF Applied Part
Supply Connection:	AC Operation: 120 VAC (nominal) 60Hz; 10A
Internal Battery Operation:	24 VDC Internal Battery
Mode of Operation:	Continuous
Protection Against Hazards of Explosion:	Not protected. (Ordinary)
Protection Against Ingress of Liquids:	Not protected. (Ordinary)
Degree of Electrical Connection Between Equipment and Patient:	Equipment designed for non-electrical connection to the patient.
Degree of Mobility:	Mobile

WARNING: Possible explosion hazard. Do not operate machine near flammable anesthetic agents or other flammable substances. Do not use flammable anesthetic agents (i.e., ether or cyclopropane.)

5.2 ASTM F 1208 – 89 (2005) Disclosures

Based on the following disclosures, the **AS3000** meets ASTM Standard Specification F1208 for Anesthesia Breathing Systems.

5.2.1 Leakage of Breathing System

The **AS3000** complies with ASTM F 1208 – 89 (2005) section 7.1.1 — The maximum leakage of the breathing system does not exceed 300 mL/min when pressurized to 3.0 kPa (30 cmH_2O).

5.2.2 Resistance of Breathing Systems

The typical pressure drops due to inspiratory and expiratory gas flow in the breathing system at reference flows of 0.5 and 1.0 liter/sec are:

- With Expiratory flow = 0.5 liter/sec then Resistance = 1.5 cmH_2O
- With Expiratory flow = 1.0 liter/sec then Resistance = 5.4 cmH_2O
- With Inspiratory flow = 0.5 liter/sec then Resistance = 1.1 cmH_2O
- With Inspiratory flow = 1.0 liter/sec then Resistance = 3.5 cmH_2O

5.2.3 Volume of Gas not delivered to patient due to Internal Compliance

- 95 ml at 2 kPa
- 200 ml at 4 kPa

5.2.4 CO_2 Absorber Resistance

For a filled CO_2 absorber, resistance at 1 Liter/sec flow = 6.9 cmH_2O.

5.2.5 CO_2 Absorber Capacity

CO_2 absorber capacity is 2 pre-paks or 1500 ml in each canister.

5.2.6 Unidirectional Valve Opening Pressure

The pressure to open moist inspiratory and expiratory valves does not exceed 0.15 kPa (1.5 cmH_2O).

5.3 General

5.3.1 Dimensions

Height: 54.3 in ± 0.2 in (1380 mm ± 5 mm)

Width: 25.6 in ± 0.2 in (650 mm ± 5 mm)

Depth: 27.2 in ± 0.2 in (690 mm ± 5 mm)

5.3.2 Weight (without vaporizers or gas cylinders)

326 lbs or less (148 kg or less)

5.3.3 Stability Configurations and Conditions

Tilted through an angle of 10°, front, both sides, and back, with all drawers loaded to 10 lbs each and left open. Back tilt performed with three gas cylinders attached.

WARNING: Due to the size and weight of the A3000, it should only be moved by qualified personnel.

WARNING: To avoid tip hazards, use care when moving the AS3000 up or down inclines, around corners and across thresholds. Remove all monitoring equipment mounted to the side of the AS3000 prior to transport. Do not attempt to roll the AS3000 over hoses, cords or other obstacles.

WARNING: Remove all equipment from the top shelf of the AS3000 before moving.

5.4 Environmental

Operating temperature:	+50 to 104°F (+10 to +40°C)
Storage temperature:	+14 to 140°F (-10 to +60°C)
Humidity (operating and storage):	15-90% RH, non-condensing
Atmospheric pressure (operating and storage):	700 to 1060 hPa

5.5 Electrical

5.5.1 Electrical Power Requirements

Mains power supply:	100 to 240 VAC, 50/60 Hz, 10 A
Current input:	120 VAC - 10 A (2 A for **AS3000**, 8 A for auxiliary outlets)
Power consumption:	Less than 200 VA (not including auxiliary outlets)
Main Fuse:	2 x 10A

5.5.2 Battery Power Requirements

Battery:	2 x 12 V Sealed Lead Acid
Battery run time:	45 minutes minimum
Battery charge time:	8 hours maximum

5.5.3 Auxiliary Outlets

Number of outlets:	4
Output voltage per Outlet:	120 VAC, 60 Hz, 2A maximum
Fuses:	4 × 2 A

NOTE: IEC 60601-1-1 applies when medical electrical equipment, non-medical electrical equipment, or combinations thereof are connected to the auxiliary mains socket outlet(s).

5.6 Pneumatic

5.6.1 Central Gas Supply Requirements

40.6 psi to 87.0 psi (280 kPa to 600 kPa) for all three gases (O_2, N_2O, Air)

5.6.2 Cylinder Gas Supply Requirements

E Cylinder / pin indexed per CGA V-1 for all three gases (O_2, N_2O, Air)

5.7 Gas Management

5.7.1 Ratio System

Integrated with automatic N_2O cutoff when O_2 fails (minimum of 21% Vol% O_2 in fresh gas).

5.8 Breathing System

Absorber capacity:	Loose Fill 2 x 1500 ml or 2 Pre-paks
Absorber system:	Loose fill or Pre-pak canisters
Condensation block:	Heated Breathing System (35 +5/- 2°C)
Block heater warm-up time:	Less than 100 minutes at 10°C ambient temperature and less than 45 minutes at 20°C ambient temperature
System compliance:	Approx. 5 ml/Pa x 100 with standard hoses

5.9 Ventilator

Electronically controlled, gas driven bellows ventilator with fresh gas compensation complies with ISO 8835-5.

Ventilation modes:	CMV (Volume), PCV (Pressure Control), SIMV (Synchronized Volume), Pressure Support, Manual, and Spontaneous
Patient types:	Adult and Child
Tidal volume:	40 - 1400 ml Child: 40 - 400 ml (± 17% or at least 20 ml) Adult: 300 - 1400 ml (± 15% or at least 50 ml)
Pressure delivery range:	5 - 70 cmH_2O Manual and PCV modes 3 - 80 cmH_2O PS and SIMV modes
Ventilation frequency:	2 - 60 bpm

CMV+PCV	SIMV+PS
Child: 4 - 60 bpm	Child: 2 - 60 bpm
Adult: 4 - 60 bpm	Adult: 2 - 60 bpm

I: E ratio:	1:1; 1:1.5; 1:2, 1:2.5, 1:3, 1:3.5, 1:4, 1:4.5, 1:5 (not available in SIMV or PS modes)
Inverse I:E ratio:	1.5:1, 2:1, 2.5:1, 3:1, 3.5:1, 4:1 (not available in SIMV or PS modes)
Plateau (End Insp.):	Off, 5% - 60% of inspiratory period (CMV and SIMV modes only)

PEEP:	Off, 3 - 30 cmH_2O 3 - 12 cmH_2O (± 2 cmH_2O) 13 - 17 cmH_2O (± 3 cmH_2O) 18 - 24 cmH_2O (± 6 cmH_2O) 25 - 30 cmH_2O (± 12 cmH_2O)
Pressure limitation:	PMAX in CMV and SIMV modes is equal to High Airway Pressure alarm setting.
P_{TARGET}:	(PEEP + 5 cmH_2O) - 70 cmH_2O (PCV mode only) 5 - 29 cmH_2O (± 3 cmH_2O) 30 - 70 cmH_2O (± 7 cmH_2O)
T_{insp}:	0.2 - 5.0 sec (± 10% or 0.1, whichever is greater) (SIMV mode only)
Trigger:	1 - 15 l/min (± 1.3 l/min) (SIMV and PS modes only)
ΔP Pressure support:	3 - 50 cmH_2O (PS and SIMV modes only) Child: 3 - 50 (± 3 cmH_2O) Adult: 3 - 35 (± 3 cmH_2O); 36 - 50 (± 12 cmH_2O)
T_{SLOPE}/Insp Flow:	0 - 2 sec (± 1.0 sec) (PCV, SIMV, and PS modes only)
Freq min/Apnea:	2 - 60 bpm (± 1 bpm) (PS mode only)
Max. Insp. pressure: (pneumatic safety valve)	80 cmH_2O (± 10 cmH_2O)
Manual pressure control: (APL Valve)	0 - 70 cmH_2O
Fresh Gas Compensation:	Automatic
Compliance test:	Automatic after confirmation
Leak tests:	Automatic after confirmation
Oxygen monitor: (per ISO 21647:2004)	Type: Galvanic Fuel cell FiO_2 display 0 - 100 vol% O_2, resolution 1%, response time (80%) less than 10 sec.
Pressure monitor:	Real-time graphics (waveform) Numerical pressure values for PEEP, Pmean, Ppeak, Pplateau Pressure range: –20 to 99 cmH_2O

	Resolution: 1 cmH_2O
Volume monitor:	Real-time graphics (waveform) Numerical values for Tidal volumes, breathing frequency, minute volumes
	Tidal Volume Range: 0 to 2900 ml
	Minute Volume Range: 0.1 to 28 liters
	Rate: 0 to 256 bpm
	Resolution Tidal Volume: 1 ml
	Resolution Minute Volume: 0.1 liters

5.9.1 Accuracy of the measurements after 5 breaths

Pressure:	± 20% of the measured value, at least 2 cmH_2O
O_2:	± 3 Vol %*
Volume:	Adult mode: ± 15% of the measured value* Child mode: 25 ml or ± 15% of the measured value (whichever is greater)*
Flow tubes:	± 10% of full scale* (per ASTM F1101-90 2003)
Rate:	± 1 bpm*

* *ATPS (Ambient Temperature Pressure Saturated)*

5.10 Anesthetic Gas Scavenging System (Low Flow)

Flow Range:	25 to 50 l/min
Maximum constant flow before spillage occurs:	50 l/min
Particle Filter:	Replaceable

5.11 Inputs / Outputs

5.11.1 Electrical

5.11.1.1 Input Power

Input power is provided via a captive line cord with a 120 volt/14 A hospital grade plug.

5.11.1.2 Auxiliary Outlets

Four 120-volt outlets

5.11.1.3 O_2 Sensor

Two-pin connector for O_2 cell cable.

5.11.1.4 Breathing System Heater

Four-pin connector for Breathing System Heater cable.

5.11.1.5 External Communication Port

Port B is available for RS-232 digital communication per Communication Protocol Document (P/N 0070-00-0706). Contact Mindray for more information.

5.11.2 Pneumatic

5.11.2.1 Pipeline connections

DISS threaded body as per CGA V-5 for all three gases (O_2, N_2O, Air)

5.11.2.2 Cylinder connection(s)

Three E-cylinder gas tank yokes, pin indexed (PISS) by gas type (O_2, N_2O, Air), per CGA V-1.

5.11.2.3 Vaporizer connection(s)

Two vaporizers (max) using the Selectatec mounting system.

5.11.2.4 Breathing System Connections

Pneumatic connectors are provided on the Breathing System. One connection each for the inspiration and expiratory hoses of the pneumatic circuit. A connection for the breathing bag and a port for the O_2 fuel cell. A Plug connection for leak testing. A Drive Gas hose connection, a breathing system pneumatics connection, an AGSS connector to provide the exhaust to the scavenger, and a CGO hose.

5.11.2.5 CGO (Common Gas Outlet)

Connector on side of machine provides fresh gas to the Breathing System.

5.11.2.6 Oxygen Output Connectors

Tapered fitting supplies output of Aux. O_2 Flowmeter. DISS O_2 connector is available on side of machine to provide wall O_2 to a jet ventilation device or other device.

5.11.2.7 Oxygen Gas Power Outlet

DISS Male O_2 fitting on the left side of the machine which provides a maximum flow of 90 l/min at a pressure range of 40.5 to 87 psi.

5.12 Displays / Controls

5.12.1 Electronic

5.12.1.1 User Interface

Display - Color LCD

Keypad Area - incorporates an AC power LED, hard keys, and a Navigator™ Knob.

- **AC Power LED** - a green LED that indicates when AC power is applied
- **Hard Keys** - as follows:
  a. **MANUAL/AUTO**
  b. **ALARM LIMITS**
  c. **MUTE**
  d. **SPIROMETRY**
  e. **MENU**
  f. **NORMAL SCREEN**
- **Navigator™ Knob** - located in the Keypad Area for control of the user interface

5.12.1.2 Main Switch

ON/OFF switch for power to the **AS3000** system.

5.12.1.3 Vaporizer/Work Light

A three-position switch (OFF, LOW, and HIGH) that controls the lighting over the work surface and vaporizers.

5.12.1.4 Audio Indicators

An audio speaker is provided to annunciate alarms and key presses. Audio alarms are in accordance with IEC60601-1-8. The measured sound pressure range for the audio alarm is 76.6 dB(A) to 81.5 dB(A).

5.12.2 Pneumatic

5.12.2.1 Line Pressure Gauges

Three line pressure gauges monitor the pipeline pressure supply of O_2, N_2O, and Air. The range of each gauge is 0 to 145 psi (0 to 1000 kPa).

5.12.2.2 Cylinder Pressure Gauges

Cylinder pressure gauges are provided to monitor the cylinder tank pressure for O_2, N_2O, and Air. The range of each gauge is 0 to 3500 psi for O_2 and Air, and 0 to 1400 psi for N_2O.

5.12.2.3 Flowmeter and Control Valve

Three control knobs, one each for N_2O, Air, and O_2 are used to set the fresh gas dosing flow. Flow set by the control knobs is monitored by six flowmeter tubes. Two each for N_2O, Air, and O_2. The scale of the flowmeters is,

N_2O High Range:	1 to 12 L/min
N_2O Low Range:	0.1 to 1 L/min
Air High Range:	1 to 15 L/min
Air Low Range:	0.1 to 1 L/min
O_2 High Range:	1 to 10 L/min
O_2 Low Range:	0.1 to 1 L/min

5.12.2.4 O_2 Flush

A push button O_2 flush valve supplies O_2 flow directly to the fresh gas outlet when depressed. The button returns to its original closed position when released.

5.12.2.5 APL Valve

The APL valve for limiting maximum breathing pressure in manual mode is located on the Breathing System block.

5.13 Electromagnetic Capability

The **AS3000** meets the requirements of IEC 60601-1-2/EN 60601-1-2.

NOTE: The AS3000 needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided below.

NOTE: Portable and mobile RF communications equipment can affect the AS3000. See tables 5-1 through 5-4 that follow.

TABLE 5-1

GUIDANCE AND DECLARATION - ELECTROMAGNETIC EMISSION

The **AS3000** is intended for use in the electromagnetic environment specified below. The customer or the user of the **AS3000** should assure that it is used in such an environment.

EMISSIONS TEST	COMPLIANCE	ELECTROMAGNETIC ENVIRONMENT - GUIDANCE
RF emissions CISPR 11	Group 1	The **AS3000** uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class A	The **AS3000** is suitable for use in all establishments other than domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/ Flicker emissions IEC 61000-3-3	Complies	

TABLE 5-2

GUIDANCE AND DECLARATION - ELECTROMAGNETIC IMMUNITY

The **AS3000** is intended for use in the electromagnetic environment specified below. The customer or the user of the **AS3000** should assure that it is used in such an environment.

IMMUNITY TEST	IEC 60601 TEST LEVEL	COMPLIANCE LEVEL	ELECTROMAGNETIC ENVIRONMENT - GUIDANCE
Electrostatic discharge (ESD) IEC 61000-4-2	±6 kV contact ±8 kV air	±6 kV contact ±8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/ output lines	±2 kV for power supply lines N/A	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV differential mode ±2 kV common mode	±1 kV differential mode ±2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment.

TABLE 5-2 (Continued)

GUIDANCE AND DECLARATION - ELECTROMAGNETIC IMMUNITY

The **AS3000** is intended for use in the electromagnetic environment specified below. The customer or the user of the **AS3000** should assure that it is used in such an environment.

IMMUNITY TEST	IEC 60601 TEST LEVEL	COMPLIANCE LEVEL	ELECTROMAGNETIC ENVIRONMENT - GUIDANCE
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	<5% U_T (>95% dip in U_T) for 0.5 cycle 40% U_T (60% dip in U_T) for 5 cycles 70% U_T (30% dip in U_T) for 25 cycles <5% U_T (>95% dip in U_T) for 5 sec	<5% U_T (>95% dip in U_T) for 0.5 cycle 40% U_T (60% dip in U_T) for 5 cycles 70% U_T (30% dip in U_T) for 25 cycles <5% U_T (>95% dip in U_T) for 5 sec	Mains power quality should be that of a typical commercial or hospital environment. The **AS3000** requires continued operation during power mains interruptions and is therefore provided with batteries that supply uninterruptible power.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.

U_T is the A.C. mains voltage prior to application of the test level.

TABLE 5-3

GUIDANCE AND DECLARATION - ELECTROMAGNETIC IMMUNITY

The **AS3000** is intended for use in the electromagnetic environment specified below. The customer or the user of the **AS3000** should assure that it is used in such an environment.

IMMUNITY TEST	IEC 60601 TEST LEVEL	COMPLIANCE LEVEL	ELECTROMAGNETIC ENVIRONMENT - GUIDANCE
			Portable and mobile RF communications equipment should be used no closer to any part of the **AS3000** than the separation distance derived from the following calculations: **Recommended separation distance**
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3 Vrms	$d = 1.2 \times \sqrt{P}$

TABLE 5-3 (Continued)

GUIDANCE AND DECLARATION - ELECTROMAGNETIC IMMUNITY

The **AS3000** is intended for use in the electromagnetic environment specified below. The customer or the user of the **AS3000** should assure that it is used in such an environment.

IMMUNITY TEST	IEC 60601 TEST LEVEL	COMPLIANCE LEVEL	ELECTROMAGNETIC ENVIRONMENT - GUIDANCE
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	$d = 1.2 \times \sqrt{P}$ 80 MHz to 800 MHz $d = 2.3 \times \sqrt{P}$ 800 MHz to 2.5 GHz where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and *d* is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,[a] should be less than the compliance level in each frequency range.[b] Interference may occur in the vicinity of equipment marked with the following symbol:

NOTE: At 80 MHz and 800 MHz, the higher frequency range applies.

NOTE: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

a Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast, and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the AS3000 is used exceeds the applicable RF compliance level above, the AS3000 should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the AS3000.

b Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

TABLE 5-4

RECOMMENDED SEPARATION DISTANCES BETWEEN PORTABLE AND MOBILE RF COMMUNICATIONS EQUIPMENT AND THE AS3000

The **AS3000** is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the **AS3000** can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the **AS3000** as recommended below, according to the maximum output power of the communications equipment.

RATED MAXIMUM OUTPUT POWER (*P*) OF TRANSMITTER IN WATTS (W)	**SEPARATION DISTANCE (*d*) IN METERS (m) ACCORDING TO FREQUENCY OF TRANSMITTER**		
	150 kHz to 80 MHz	**80 MHz to 800 MHz**	**800 MHz to 2.5 GHz**
	$d = 1.2 \times \sqrt{P}$	$d = 1.2 \times \sqrt{P}$	$d = 2.3 \times \sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

For transmitters rated at a maximum output power not listed above, the recommended separation distance *d* in meters (m) can be determined using the equation applicable to the frequency of the transmitter, where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE: At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

NOTE: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

5.14 Warranty Statements

Mindray DS USA, Inc. warrants that components within the anesthesia system will be free from defects in workmanship and materials for the number of years shown on the invoice. Under this extended warranty, Mindray DS USA, Inc. will repair or replace any defective component at no charge for labor and/or materials. This extended warranty does not cover consumable items such as (but not limited to) batteries and external cables.

Recommended preventative maintenance, as prescribed in the Service Manual, is the responsibility of the user, and is not covered by this warranty.

Except as otherwise provided herein, the terms, conditions, and limitations of Mindray DS USA, Inc.'s standard warranty will remain in effect.

Mindray DS USA, Inc. warrants that its products will be free from defects in workmanship and materials for a period of one (1) year from the date of purchase except that disposable or one-time use products are warranted to be free from defects in workmanship and materials up to a date one year from the date of purchase or the date of first use, whichever is sooner. This warranty does not cover consumable items such as, but not limited to, batteries, external cables, sensors, cuffs, hoses, or mounts.

Mindray DS USA, Inc. will not be liable for any incidental, special, or consequential loss, damage, or expense directly or indirectly arising from the use of its products, liability under this warranty and the buyer's exclusive remedy under this warranty is limited to servicing or replacing at Mindray DS USA, Inc.'s option at the factory or at an authorized distributor, any product which shall under normal use and service appear to the Company to have been defective in material or workmanship.

No agent, employee, or representative of Mindray DS USA, Inc. has any authority to bind Mindray DS USA, Inc. to any affirmation, representation, or warranty concerning its products, and any affirmation, representation or warranty made by any agent, employee, or representative shall not be enforceable by buyer.

This warranty is expressly in lieu of any other express or implied warranties, including any implied warranty or merchantability or fitness, and of any other obligation on the part of the seller.

Damage to any product or parts through misuse, neglect, accident, or by affixing any non-standard accessory attachments or by any customer modification voids this warranty. Mindray DS USA, Inc. makes no warranty whatever in regard to trade accessories, such being subject to the warranty of their respective manufacturers.

A condition of this warranty is that this equipment or any accessories which are claimed to be defective be returned when authorized, freight prepaid to Mindray DS USA, Inc., Mahwah, New Jersey 07430. Mindray DS USA, Inc. shall not have any responsibility in the event of loss or damage in transit.

Calibration may be performed without the need to disassemble the instrument. It is the responsibility of the purchaser to perform calibration as necessary, in accordance with the instructions provided in this manual.

5.15 Disclaimers

5.15.1 Product Improvements

Mindray DS USA, Inc. retains the right to modify the machine and/or operating instructions without prior notification. These operating instructions explain all features of the **AS3000** system and are correct at time of manufacture. Instructions and models produced at a later stage, may contain improvements or modifications that were not included in previous models.

5.16 Phone Numbers and How To Get Assistance

A network of service representatives and factory-trained distributors is available. Prior to requesting service, perform a complete operational check of the instrument to verify proper control settings. If operational problems continue to exist, contact the Service Department at (800) 288-2121, ext: 8116 for Technical Support or (201) 995-7875 for assistance in determining the nearest field service location.

Please include the instrument model number, the serial number, and a description of the problem with all requests for service.

Warranty questions should be directed to a local representative. A list of offices, along with their phone numbers, is provided at the end of this manual.

NOTE: **Upon request, calibration instructions or other information will be provided to assist the user's appropriately qualified technical personnel in repairing those parts of the AS3000 which are designated as repairable.**

5.17 Manufacturer's Responsibility

The effects on safety, reliability, and performance of the equipment are the manufacturer's responsibility only if:

- **a.** assembly operations, extensions, readjustments, modifications or repairs are carried out by authorized personnel; and
- **b.** the electrical installation of the relevant room complies with the appropriate requirements; and
- **c.** the equipment is used in accordance with the instructions for use

6.0 *Glossary*

6.1 Glossary of Terms

AD/DA	Analog to Digital/Digital to Analog
AGSS	Anesthetic Gas Scavenging System
APL	Airway Pressure Limiting
BDU	Basic Digital processing Unit
cmH_2O	Centimeters of Water
CMV	Volume Controlled Continuous Mandatory Ventilation
EEPROM	Electrically Erasable Programmable Read Only Memory
FiO_2	Fraction of inspired oxygen
Freq	Frequency
$Freq_{MIN}$	Minimum Frequency (PS mode only)
IC	Integrated Circuit
I:E	Ratio of Inspiratory Time to Expiratory Time
L	liter
L/min	liters per minute
ml	milliliter
MV	Minute Volume
N/A	Not Applicable
Paw or PAW	Airway Pressure
PCV	Pressure Controlled Ventilation
PEEP	Positive End-Expiratory Pressure
PIP	Peak Inspiratory Pressure
PS	Pressure Support Ventilation
P_{TARGET}	Target Pressure
ΔP	Differential Pressure

SIMV	Synchronized Intermittent Mandatory Ventilation
T_{INSP}	Inspiratory Time
T_P	Inspiratory Pause Time
T_{SLOPE}	Inspiratory Slope Time
Trigger	Flow Trigger
VO_2I	Oxygen Consumption Index
V_T	Tidal Volume
WDT	Watch Dog Timer

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